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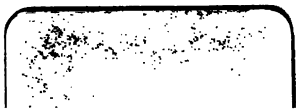
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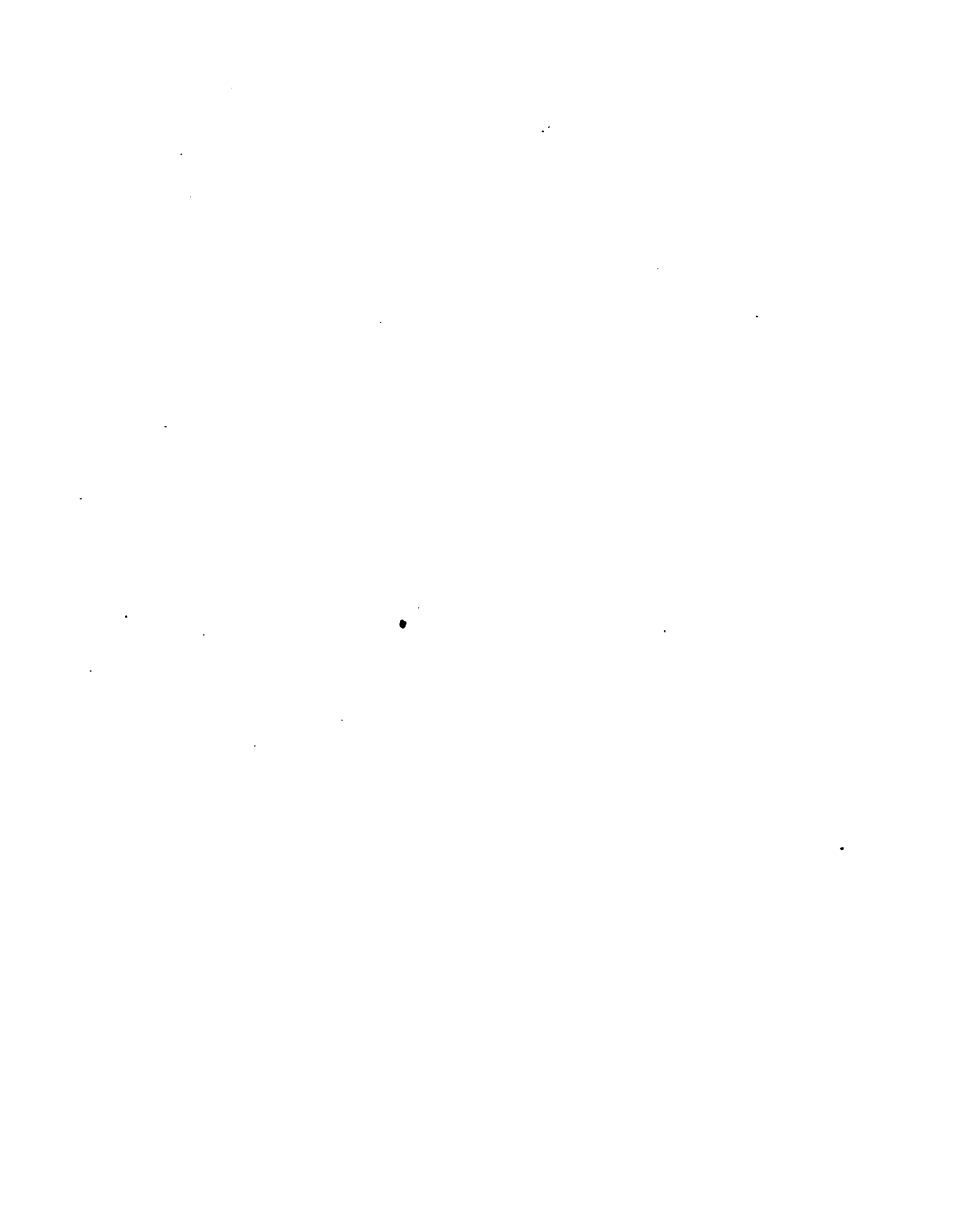
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PATTERSON'S
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TO
ZOOLOGY.

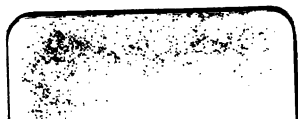


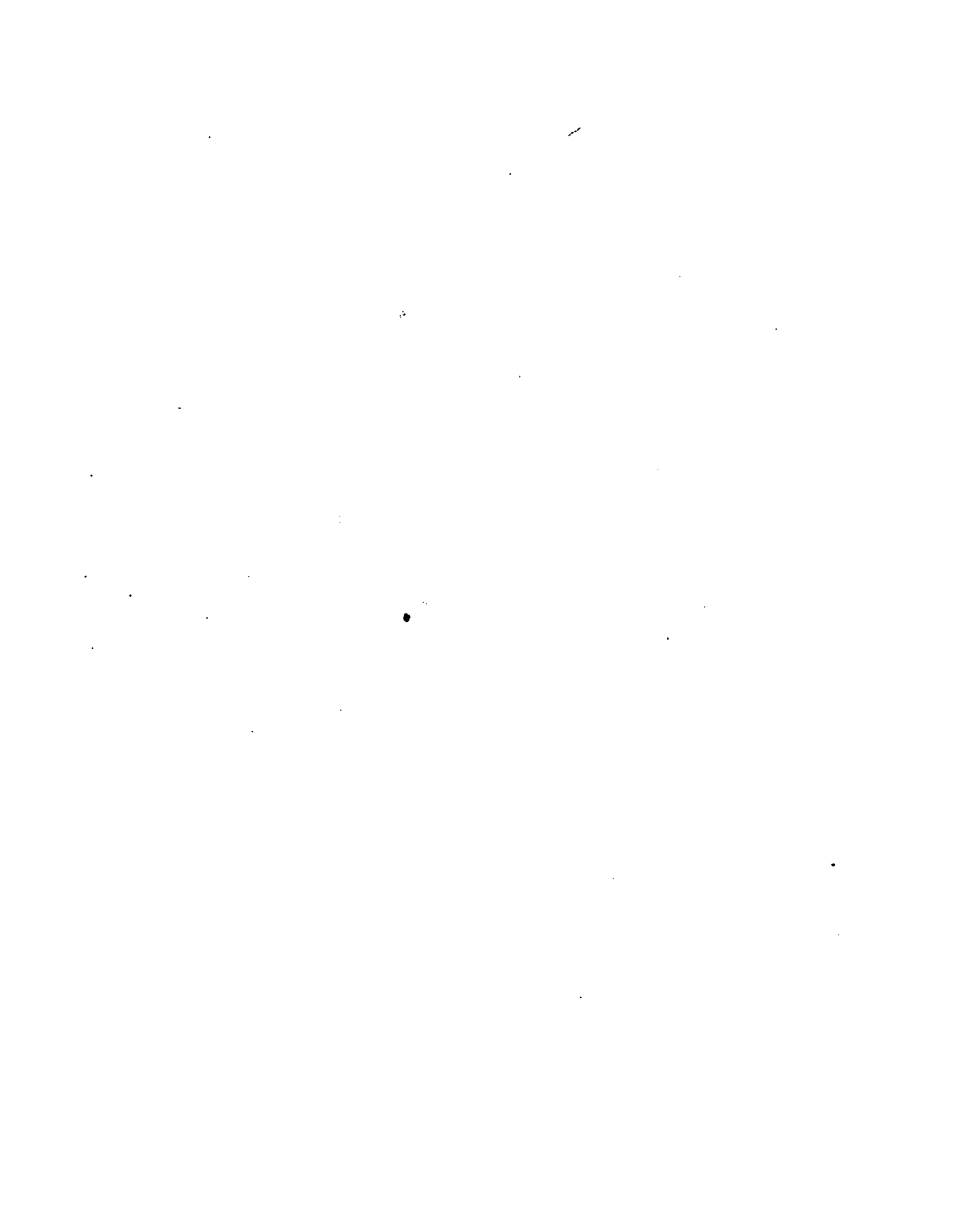
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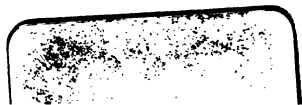


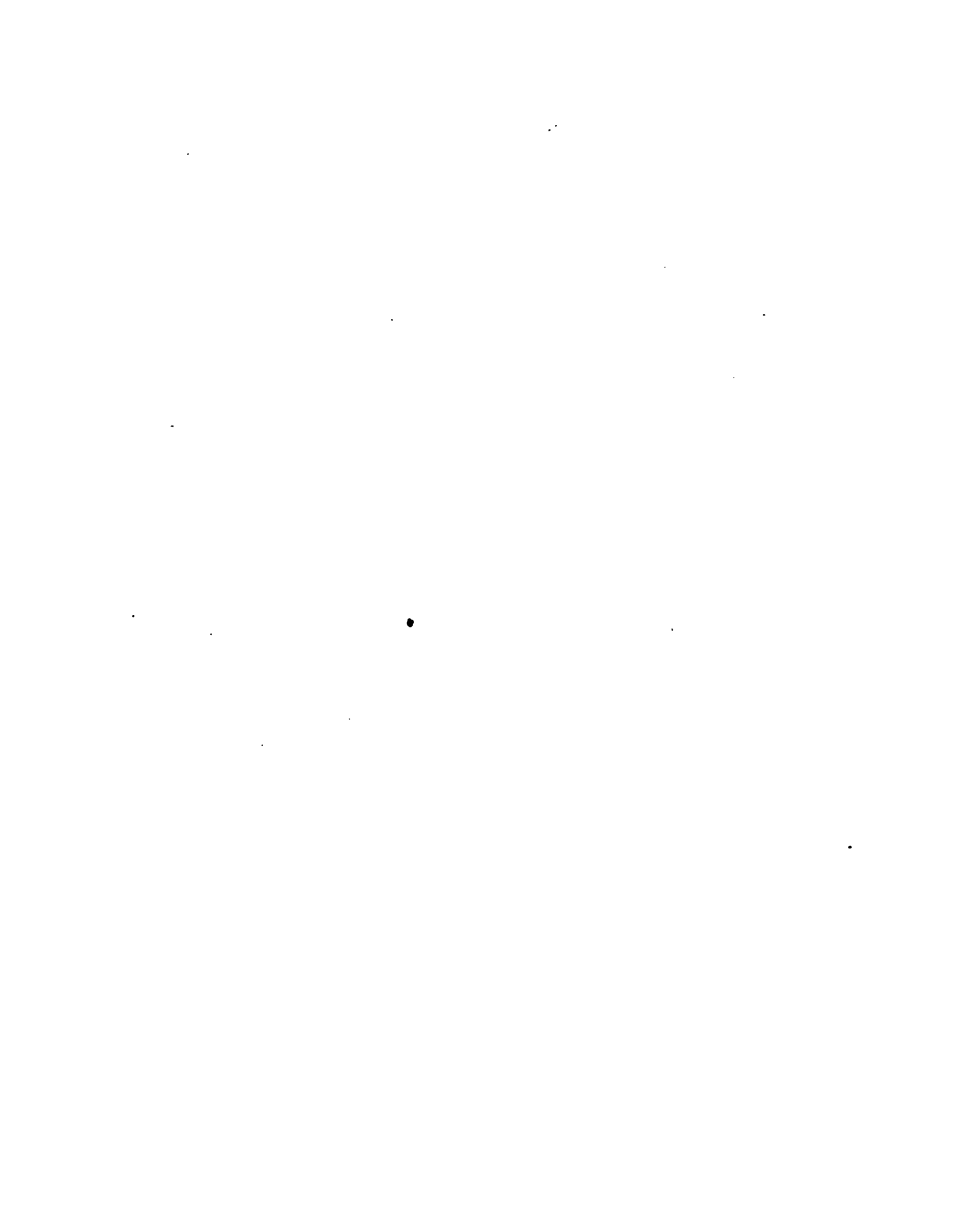
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FIRST STEPS

TO

Z O O L O G Y.

BY ROBERT PATTERSON,

AUTHOR OF

"ZOOLOGY FOR SCHOOLS."

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WITH 244 ILLUSTRATIONS.  
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LONDON:
SIMMS AND MINTYRE,
13, PATERNOSTER ROW, AND 26, DONEGALL STREET,
BELFAST.

1849.





PREFACE.

SINCE the publication of the "Introduction to Zoology for the Use of Schools," I have been favoured with many communications from parents and teachers, stating that they felt the want of a book adapted for more juvenile readers.

In deference to their wishes, I have now endeavoured to furnish one, shorter, simpler, and with fewer "hard words." The title I owe to the kind suggestion of my friend, Dr. J. L. Drummond, author of "First Steps to Botany," and other justly popular works. The various references and acknowledgments given in the "Introduction," have, in most instances, been omitted here, as unsuitable to the little book.

R. P.

Belfast, 3, College Square North,

November 15th, 1848.



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FIRST STEPS TO ZOOLOGY.

ON the titlepage of this little book is the word "Zoology." A learner will naturally ask, "What does it mean?"

It means a knowledge of animals. The science which teaches the structure, habits, and classification of animals is *Zoology*; the person possessed of such knowledge is a *Zoologist*.

When we use the word "animals" in this sense, we do not mean those only that resemble the domestic quadrupeds of these countries, or the tiger and elephant of other lands; but we include birds, fishes, snakes, and frogs. Nor do we stop with these; we apply the term to the snail and the oyster, to the crab and the worm, to the sea-urchin and the jelly-fish, and to those living atoms which the unassisted eye cannot perceive.

These creatures differ widely from each other in size, structure, and habits. Some of them are fitted to bear the cold of the arctic regions, and some to live under the scorching heat of the tropics. They people the air, the earth, and the waters, and in countless myriads are spread abroad over the entire surface of the globe.

This vast assemblage of animals it is the business of the

Zoologist to distribute into groups, distinguished by some well-defined characters; so that in his classification those may be placed together which are alike, and those may be separated, more or less remotely, which are different. The task is one that no single individual could accomplish by his own efforts; but it has been effected by the combined and successive labours of many; and in this way the entire animal kingdom has been divided into four great groups. These are distinguished by their peculiarities of structure; not so much by those which are external as by those which are internal, and are connected with the nerves.

The first of the groups contains those animals which have a skull, and a backbone composed of a number of joints or *vertebræ*, as in our own bodies. All such animals are termed "vertebrate," and all in which the skull and backbone are wanting are called "invertebrate."

The following are the four groups or sub-kingdoms established by Baron Cuvier:—

I. Vertebrated animals (*Vertebrata*).

INVERTEBRATE.

II. Soft-bodied animals (*Mollusca*).

III. Articulated animals (*Articulata*).

IV. Radiated animals (*Radiata*).

Let us begin with those at the foot of the scale, and gradually ascend to those beings which occupy a higher rank:—

RADIATED ANIMALS.

“O Lord, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches: so is this great and wide sea, wherein are things creeping innumerable, both small and great beasts.”

—PSALMS.

IF we pick up a Star-fish which has been left on the beach by the retiring tide, we notice that the limbs or arms of the animal are like rays spreading out from a common centre. The Star-fish furnishes therefore a good illustration of what is meant by a “rayed” or “radiated” animal. There are, however, many others belonging to the group in which the rayed appearance is not exhibited in the outline of the body. It is easily discernible in the Sea-urchin, although the figure is rounded; but in others it must be sought for in the radiated arrangement of the parts surrounding the mouth; and in some it can only be detected by an examination of the internal structure.

The Radiated animals are arranged in four great groups or “Classes.”

- I. Infusory Animacules (*Infusoria*).
- II. Internal Parasites (*Entozoa*).
- III. Polypes (*Zoophyta*).
- IV. Rayed Animals (*Radiaria*).

CLASS I.—INFUSORY ANIMALCULES.

INFUSORIA.

“Where the pool
 Stands mantled o’er with green, invisible
 Amid the floating verdure millions stray.”—THOMSON.

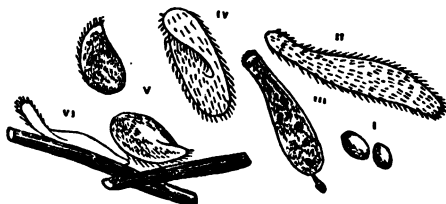


Fig. 1.—INFUSORIA.

If any vegetable substance be allowed to remain for about ten days in a glass of water, exposed in a window to the rays of the sun, the water will appear to the naked eye to have undergone little change. But if a drop be taken from the surface and placed under the microscope, it will exhibit such a multitude of living beings swimming about, that the spectacle cannot be looked upon for the first time without surprise, and even astonishment. If a drop of the water containing them be placed between two pieces of glass, they will be seen swimming about with perfect ease in that little film of liquid, and passing and repassing without ever touching. Nor is the feeling of wonder diminished when we endeavour to calculate their size, and form.

some estimate of their numbers. Some are so very minute, that Professor Ehrenberg has calculated that two thousand of them placed together would measure but one line, or the twelfth part of an inch. According to this estimate, a drop of water might contain 500 millions of them, a number nearly equalling that of the whole human race at present living on the earth.

These animalcules or little animals, abound in infusions of animal or vegetable matter, and from this circumstance derive their name. But they are not limited to such situations; they are met with not only in stagnant pools, but in lakes and rivers, in the purest water taken from the open sea, and even in that of the arctic ocean.

There are many species of these animalcules, but they are all included in one or other of two great divisions.

The first of these is named the "many stomached" (*Polygastrica*), because the body contains a number of sacs or stomachs in which the food is received (*Fig. 2*). It may naturally be asked, how could these be discovered in creatures so inconceivably minute. The plan adopted by Ehrenberg was very ingenious. He removed some of them from the water in which they were found, and placed them in water of the purest and most

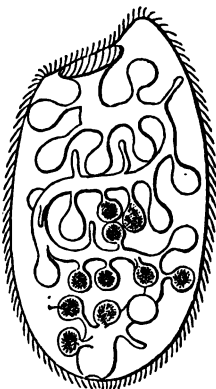


Fig. 2.—ANIMALCULR, one of the *Polygastrica*.

the purest and most

In some parts of the world these are found in great masses; yet each of these minute and scarcely visible shells is the production of an animal which has passed away, and left behind but this tiny memorial of its existence.

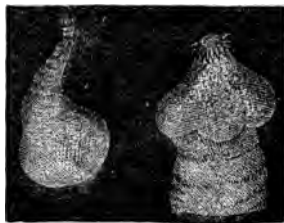
CLASS II.—INTERNAL PARASITES.

ENTOZOA.

“Verily, for mine owne part, the more I looke into Nature’s workes, the sooner am I induced to beleewe of her, even those things that seem incredible.”—HOLLAND’S PLINY.

THE body of every vertebrate animal forms the abode of many other animals that live within it. These creatures constitute the class *Entozoa*, a word which simply means “within an animal,” and is very appropriate to the internal parasites, which constitute the present group.

With this class we are as yet imperfectly acquainted; but some idea of its numbers may be formed from the fact, that no species of animal is supposed to be exempt from their attacks, and that the human body is infested with no less than eighteen species. It is stated that every animal has one



^a ^b
Fig. 5.—ENTOZOOON.*

* Fig. 5, *a*, Cyst magnified; *b*, head still further enlarged.

or more species peculiar to itself. If so, the number of species among the Entozoa must exceed that of all other animals existing in the world.

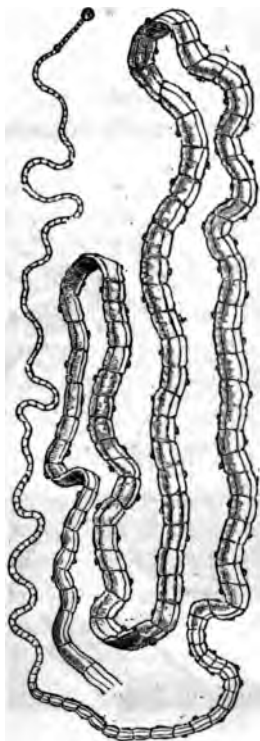


Fig. 6.—TAPEWORM.

compared to trees or plants which fling off their seeds when ripe.

These singular beings differ widely in their structure. Some resemble delicate transparent membranes filled with water. It is one of these (*Fig. 5*) that gives to the flesh of the pig the appearance termed *measly*. The farmer is well acquainted with two other kinds—one found in the brain, and another in the liver of the sheep. One species that infests the human body is the common Tapeworm (*Fig. 6*), which is occasionally found several yards in length. Its head is furnished with suckers and bristles, by means of which it can fix itself securely. Each joint of the body has the power of producing thousands of *ova* or eggs. When these come to maturity, the lower portion of the body separates from the upper; so that the Tapeworm may, from this peculiarity, be com-

CLASS III.—POLYPPES.

ZOOPLYTA.

“Here, too, were living flowers,
Which, like a bud comparted,
Their purple cups contracted;
And now, in open blossom spread,

Stretched like green anthers many a seeking head.”

THE animals belonging to this class were formerly regarded as vegetables. They were afterwards considered to be partly of an animal and partly of a vegetable nature, which idea is still conveyed in the term *Zoophyte*, a word derived from the Greek, and literally meaning “animal plant.”

In the two former classes, the exterior of the body did not exhibit any radiated structure; in the present class it is seen, not in the form of the body, but in the arrangement of the parts surrounding the mouth,



Fig. 7.—SEA-ANEMONE,

ORDER I.—HYDRA-FORM POLYPES.

HYDROIDA.



Fig. 8.—HYDRAS.

The Zoophytes or Polypes may be arranged in four great divisions. The first consists of those which in structure bear a resemblance to the common fresh-water Hydra, a singular being, whose history is more strange than that of the strangest fairy tale. One species has claspers or *tentacula*, capable of being distended to many times the length of its body (*Fig. 8*). In its contracted state, it seems a little piece of jelly not larger than the half of a pea: but when engaged in the capture of its food, with the tail at the surface of the water and the head underneath, it stretches its tentacula like so many fishing-lines; and there is reason to believe that it possesses the power of giving an electric shock, or otherwise stunning by its touch the minute inhabitants of the water.

Trembley, of Geneva, found that a Hydra might without injury be turned inside out, like the finger of a glove; and if one were cut into a number of pieces, each piece would become a perfect Hydra.

The Polypes of the next division are not naked like the Hydra, but are in tubes from which the head projects. Any one who has seen the dredge bring up, from the depth of many fathoms, a number of these tubes bent and twisted together, each surmounted by what presents the appearance of a head of scarlet flowers, will not readily forget the beauty of these sea-born blossoms.

The Polypes of another group have the power of altogether withdrawing into their cells. Their common habitation presents a tree-like aspect (*Fig. 9*). These are the Corallines, whose feathery tufts may be seen on the shell of the oyster or the mussel. Each cell is occupied by a

Polype, and all are connected together in such a way that the food taken by one contributes to the nourishment of all. So great are the numbers of these Polypes, that a single sea-weed may bear upon it a population greater than that of London or Pekin.

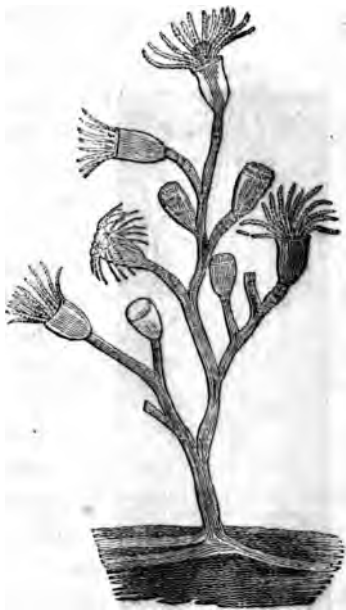


Fig. 9.—ZOOPLYTE.

ORDER II.—STAR-SHAPED POLYPES.

ASTEROIDA.

“There, with a light and easy motion,
 The Fan-coral sweeps through the clear deep sea;
 And the yellow and scarlet tufts of ocean
 Are bending like corn on the upland lea.”



The animals of the present order live only in the sea. They are never found singly, but in a community, forming altogether a polype-mass, variable in form, strengthened in different ways, and having on its surface the cells in which the polypes live, and which open on the surface in a star-like figure, whence the order takes its name (*Fig. 10*).

To this order belong the Sea-pens and the Sea-fans. The central part of the Sea-fans is formed of a substance resembling horn, which bends under the force of streams and currents, and is, by this beautiful arrangement, preserved unbroken. To this circumstance the poet has referred in the lines above quoted. In the *Isis*, the stem is composed in part of a horny and in part of a calcareous substance, arranged in alternate joints, thus combining strength

F. 10.—STAR-SHAPED POLYPES.

and flexibility. When recently taken, the stem is covered with a living membrane, in which are the polype-cells. The common Red Coral resembles the Isis in having a living rind in which the polypes find shelter (*Fig. 11*). Inside of this is found the substance known as the Red Coral of the Mediterranean. Its growth is slow, and its short, stunted stems do not require, for their protection, the beautiful and effectual contrivances exhibited in the Sea-fan and the Isis.

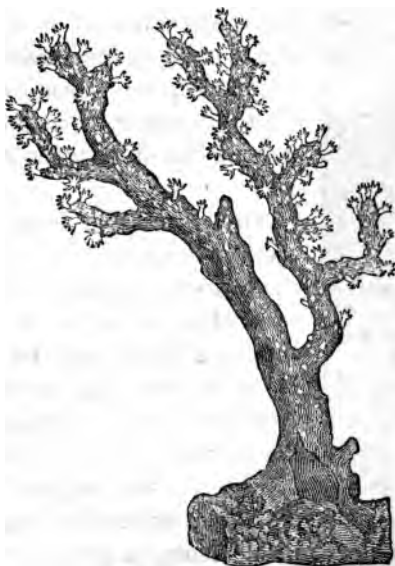


Fig. 11.—RED CORAL.

ORDER III.—SEA-ANEMONES.

HELIANTHOIDA.

—————“ Seas have—
 As well as earth—vines, roses, nettles, melons,
 Mushrooms, pinks, gilliflowers—————
 As very fishes, living in the seas.”
 —————

The scientific name of the present order denotes that the animals it includes bear a resemblance to such flowers as the daisy, the marigold, and others, which the botanist terms “compound” (*Fig. 7, 12*). The most common native species are single, with a fleshy body, live only in the sea, and have the mouth encircled with claspers or *tentacula*.



Fig. 12.—SEA-ANEMONE.

The common Sea-anemone, which is generally to be seen in the rock-pools round our shores, may be taken as a familiar example, and one which will illustrate some of the most striking peculiarities of structure.

Viewed when the tide has receded, and the rocks are left dry, the Sea-anemones, which adhere to them, appear as fleshy, inert, hemispherical bodies, of an olive tinge, or of a liver-coloured vermillion, the tint being variable. But when

the advancing tide has again covered them, they are roused to more active life,—unfold their tentacula, and present the appearance of expanded flowers.

Though found attached to the rocks, they are not fixed there permanently, but can change their place at pleasure. Some species are used as food by man, and, when boiled in sea-water, are said to have both the smell and taste of lobster. They live upon small aquatic animals of every kind, including crustacea and shell-fish; the hard and indigestible parts being rejected by the mouth, about ten or twelve hours after being swallowed.

Perhaps no fact connected with these animals is more remarkable than their power of bearing mutilation. If the tentacula be destroyed, others are soon after formed. If the animal be cut across into two distinct portions, the upper part continues to take food as usual, though for a time unable to retain it; if divided in the opposite direction, two Sea-anemones are produced; and if only a part of the base be left, a perfect animal is soon raised up.

Dr. Johnston, the learned author of a work on the British Zoophytes, mentions a characteristic occurrence respecting a Sea-anemone which had been brought to him. It might have been originally two inches in diameter, but had somehow contrived to swallow a scallop shell the size of an ordinary saucer. The shell fixed within the stomach was so placed as to divide it completely into two equal parts, so that the body stretched over it had become thin and flattened.

like a pancake. All communication between the mouth and the interior of the stomach was of course prevented, but the animal, instead of dying of starvation, took advantage of the accident to increase its enjoyments, and its chance of double fare, for a new mouth furnished with tentacula was opened up on what had been the base, and led directly to the lower stomach.

Belonging to the same order, but to a different family from the Sea-anemones, are the Coral-building Polypes of tropical seas (*Fig. 13*). Their structures have been the wonder of the navigator and the theme of the poet; and while science endeavours to reveal the process by which they are upreared, she brings forward another example that, under the dispensation of Providence, the mightiest of works can be executed by the weakest of agents.

It was formerly supposed that the Coral-building Polypes worked in unfathomable depths, and in the course of ages reared their pile to the surface of the water; but recent and widely extended observations have shown that this is not the case. The species most efficient as Coral-builders work only at limited depths, not exceeding twenty or thirty fathoms. Yet their labours, taken in connection with geological changes, are sufficient to produce reefs in the Pacific of several



Fig. 13.—CORAL.

hundred miles in length. These structures, it must be remembered, are not formed in an expanse of deep and tranquil waters, but in the midst of an ocean which is never at rest. "The breakers," as Mr. Darwin remarks, "exceed in violence those of our temperate regions; and it is impossible to behold them without feeling a conviction, that rocks of granite and quartz would ultimately yield and be demolished by such irresistible forces." Yet these coral islets stand uninjured, for here another power comes into operation. The particles of lime contained in the seawater, are separated from it by the Polypes, and united into a regular structure. "Myriads of architects are at work day and night, month after month, and we see their soft and gelatinous bodies, through the agency of the vital laws, conquering the great mechanical power of the waves of an ocean which neither the art of man nor the inanimate works of Nature could successfully resist."

When we consider that these busy millions are silently laying the foundations of islands and of continents, the future abodes of man, we must feel that the poet did not over-estimate their importance when he termed them,

"Unconscious, not unworthy instruments,
By which a hand invisible was rearing
A new creation in the secret deep."

ORDER IV.—SEA-MATS.—PLUMED POLYPES.
ASCIDIOIDA.



Fig. 14.—PLUMED POLYPE.

THE Polypes of the present order are of a higher grade than those we have been considering, and in structure approach to some of the soft-bodied animals or *Mollusca*. Each Polype is a distinct and perfect animal, and they do not exist as solitary individuals, but as populous communities. Their habitations or *polypidoms*, the little cities of which they are both the architects and the occupants, are very variable both

Fig. 14.—*a*, natural size.—*b*, a group in various positions, magnified.

in form and material, sometimes enamelling with delicate network the leaf of a sea-weed or the outside of a shell, at others rising into the aspect of miniature plants, or broad leaf-like expansions. Round the mouth is a circle of *tentacula* or claspers (*Fig. 14*), which can be extended or withdrawn at the pleasure of the animal. The tentacula are covered with minute hairlike bodies (*cilia*), which by their movements effect a double purpose, for they not only create currents which bring their food within the reach of the polypes, but they act, like gills, as organs of respiration.

To this class of Zoophytes belong the "Sea-mats;" or, to use a more scientific term, the species of the genus "flustra," a word derived from the Saxon, and signifying to weave. Some of these form a delicate gauze-like encrustation on shells and sea-weed; others present a leaf-like appearance of a determinate pattern, and furnish another example of the great abundance of animal life in some of the lower tribes. Though not thicker than common letter-paper, they exhibit, either on one or on both sides, successive rows of cells, each of which has been occupied by its own inhabitant. In one species found on these coasts, and with cells upon one side only, Dr. Grant calculates there are more than 18,000 Polypes; and the Rev. David Landsborough, in speaking of another, remarks, "by counting the cells on a square inch, I calculated that this web of silvery lace had been the work and habitation of about two millions of industrious, and, we doubt not, happy inmates; so that

this single colony, on a submarine island, was about equal in number to the population of Scotland."

The spectacle presented by one of these polypidoms, when in a saucer containing sea-water, and placed under the microscope, is full of interest. Whether the animals lie in a state of repose, or with the tentacula expanded and in full activity, their aspect and motions are all indicative of happiness. This conviction increases the pleasure with which we regard them; for truly has the poet said,—

"The heart is hard in nature——
 ———— that is not pleased
 With sight of animals enjoying life,
 Nor feels their happiness augment his own."—COWPER.

CLASS IV.—RAYED ANIMALS.

RADIARIA.

———"The firmament
 Was thronged with constellations, and the sea
 Strown with their images."—JAMES MONTGOMERY.

WE have now reached the fourth, or highest class of the radiated animals. In these the radiated structure is not confined to the nervous system, nor to the arrangement of the parts surrounding the mouth: it extends to the form of the body, and may be seen in the common Jelly-fish,

which is so abundant on our coast, or in any one of the various Star-fishes (*Fig. 15*). The two examples just men-

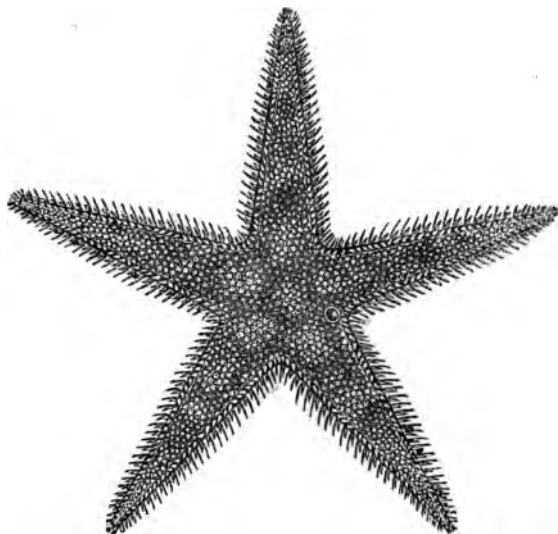


Fig. 15.—STAR-FISH.

tioned point to an obvious and very natural division of the class. The soft and jelly-like tribes belong to a group of animals whose domain is the wide and open sea; the Star-fish and the Sea-urchin, to a community whose members live at fathomable depths, in the vicinity of land. The covering of each of these groups of animals is suited to the situation which they are destined to occupy; that of the one being soft and membranous, while that of the other is hard, leathery, or prickly.

SEA-NETTLES.—ORDER ACALEPHÆ.

“Those living jellies which the flesh inflame,
 Fierce as a nettle, and from that its name;
 Some in huge masses, some that you may bring
 In the small compass of a lady’s ring;
 Figured by hand Divine—there’s not a gem
 Wrought by man’s art to be compared to them.”—CRABBE.



Fig. 16.—JELLY-FISH.

THOSE who have been in the habit of bathing in the sea during the warm summer months, may probably have experienced the severe stinging pain caused by the touch of the long thread-like appendages of the Sea-nettles or Jelly-fish (*Medusæ*); and if so, they will understand the reason why the old Greek naturalists gave to them a name signifying “nettles,” (*Acalephæ*). They are found in all seas, and please the eye, both by their glassy transparency and by their brilliant hues (Fig. 16). In the structure

of their frail and gelatinous bodies there is much to excite our surprise. They seem little else than a mass of vivified sea-water; yet, feeble as they appear, fishes and other small marine animals are quickly dissolved in their stomachs.

Among the animals belonging to the present order, there is a great variety, not only of size but of general structure and appearance; and the diversity that we witness around our own coasts, is increased by species which are inhabitants of warmer latitudes, being occasionally carried to our shores by the winds and currents of the ocean. As one example of these, the little *Velella* (*Fig. 17*) may be mentioned.

Fixed obliquely across a bluish oval disc, it exhibits a snowy crest, which has been compared to the lateen-sail of the Malay boatmen. Thus propelled, the living squadrons of this little mariner have been observed while

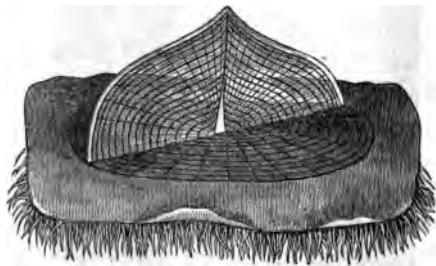


Fig. 17.—VELELLA.

passing the picturesque headlands of the Giant's Causeway, and the basaltic cliffs of other parts of the County Antrim. The engraving here given of one is copied from an original drawing made by Professor Allman, who remarks:—"The individual who sat, or rather *float*ed for his likeness, was one of a fleet of countless multitudes, which, in the Autumn of

1836, was driven upon the coast of the County of Cork. On the subsidence of the gale, which had been blowing strongly from the south-west, the coast for miles round was strown with the remains of the shipwrecked fleet."

Another species not less attractive is a native of our seas, and may very easily be obtained during the fine weather of summer or autumn. If a gauze towing-net be attached to a boat, which is rowed gently along, it is probable that, if the net be examined after a short time, there will be



Fig. 18.—BERŒ.

found among its contents some transparent bodies, differing in size, but in general about as large as a boy's marble (*Fig. 18*). These are members of a family known by the name of Berœ, from one of the sea-nymphs of classic fable. Externally they exhibit ridges like those of a melon, and are in form not unlike an orange or an apple. If gently lifted from the net, and placed in a glass of sea-water, the animals will begin to move by means of eight bands of little paddles (*cilia*), which extend from the upper to the lower extremity

of the body. A name expressive of this peculiarity of movement is applied to the group.

Their movements are ceaseless and ever varying. The action of the paddles on the water produces the most beautiful rainbow tints; and the diversity of aspect which the little creatures present, is increased by two remarkable appendages, which can in a moment be extended and displayed to their full extent, or drawn back into cavities within the body. By means of these the little Beröe can attach itself to the sides or bottom of its glassy prison, and ride, as if at anchor, moored by these singular and delicate cables.

A species of Beröe, of a larger size and different shape, is also found upon our coasts. It is furnished with four curious ear-like appendages, which are ever changing their form. The body is easily broken; and is so very transparent, that on one occasion when I had some of these animals in a jar of sea-water on the chimney-piece, the blossoms of some flowers which were also there, were distinctly seen through them.

The other great division of the Sea-nettles (*Acalephæ*) is that to which the Jelly-fish, which is so abundantly strewn upon the beach during the summer months, belongs. In the Beröes, we found that the animals moved by means of *cilia*, or rows of little paddles. The Medusæ or Jelly-fish, on the contrary, move by the expansion or contraction of the outer margin of the umbrella-shaped surface (*Fig. 16, 19*), the animal striking the water in an opposite direction to that in which it is moving. The motion is easy and graceful; and

such is the structure of the body, that every contraction of the margin not only impels the animal in its course, but



Fig. 19.—JELLY-FISH.

assists in the process of respiration. This group is divided into many genera, comprising about three hundred species. Some resemble a mushroom with its stalk; others have arms adapted for seizing; some have one simple central mouth; in others, both its structure and position are different; in some the margin is furnished with long contractile threads, whence

the well-known stinging secretion is supplied; in others, this formidable apparatus is altogether wanting.

The Medusæ differ extremely in size. Some as large as a good-sized umbrella are occasionally thrown upon our coast; others are about the size of peas; and many scarcely exceed in dimensions the head of a large-sized pin.

Some species are adorned with brilliant colours, and equal, in the richness of their hues, the brightest of our garden flowers. When from a small boat they are beheld rising and falling at pleasure, in a glassy and transparent sea, they are objects so very attractive as to excite the astonishment of the child, while they furnish matter for the contemplation of the naturalist.

The quantity of solid material contained in their bodies is much less than would generally be supposed. Professor Owen states that if the fluid parts of a Medusa, which may weigh two pounds, be drained away, there will remain only a thin film of membrane not exceeding thirty grains in weight.

A circumstance illustrative of this singularity of structure may here be mentioned:—A few years ago an eminent Zoologist, now a Professor in one of the English Universities, had been delivering some lectures in a seaport town in Scotland. In the course of these, he noticed some of the most remarkable points in the structure and habits of the Sea-nettles. After the lecture, a farmer who had been present came forward, and inquired if he had understood him correctly, as having stated that the Medusæ contained so little of solid material, that they might be regarded as little else than a mass of animated sea-water? On being answered in the affirmative, he remarked that it would have saved him many a pound had he known that sooner, for he had been in the habit of employing his men and horses in carting away large quantities of jelly-fish from the shore, and using them as manure on his farm, and he now believed they could have been of little more real use than an equal weight of sea-water. Assuming that so much as one ton weight of Medusæ recently thrown on the beach had been carted away in one load, it would be found that, according to the experiments of Professor Owen already mentioned, the entire quantity of solid material would be

only about four pounds of avoirdupois weight, an amount of solid material which, if compressed, the farmer might, with ease, have carried home in one of his coat pockets.

Perhaps there is no circumstance connected with this class of animals more attractive or more remarkable than the power they possess of emitting a beautiful phosphorescent light; and, in some of the larger Medusæ, this is of such intensity, that they have been compared to balls of fire suspended in the water.

Professor Rymer Jones, in speaking of the luminosity of the ocean, which is principally owing to these animals, remarks:—"We have more than once witnessed this phenomenon in the Mediterranean, and the contemplation of it is well calculated to impress the mind with a consciousness of the profusion of living beings existing around us. The light is not constant, but only emitted when agitation of any kind disturbs the microscopic Medusæ which crowd the surface of the ocean; a passing breeze, as it sweeps over the tranquil bosom of the sea, will call from the waves a flash of brilliancy which may be traced for miles; the wake of a ship is marked by a long track of splendour; the oars of your boat are raised dripping with living diamonds; and if a little of the water be taken up in the palm of the hand, and slightly agitated, luminous points are perceptibly diffused through it, which emanate from innumerable little *Acalephæ*, scarcely perceptible without the assistance of a microscope."

The phenomenon is not, however, confined to warmer latitudes. Sir Walter Scott, in his "Lord of the Isles," has described it in our own seas:—

"Awaked before the rushing prow,
The mimic fires of ocean glow,
Those lightnings of the wave;
Wild sparkles crest the broken tides,
And, flashing round the vessel's sides,
With elfish lustre lave,
While, far behind, their livid light
To the dark billows of the night
A gloomy splendour gave."

STAR-FISHES.—ORDER ECHINODERMATA.

"As there are stars in the sky, so there are stars in the sea."—LINK.

THE second great division of the rayed animals comprises all those with a hard or leather-like covering, which, in some species, has prickles like those of the hedgehog. They exhibit, in many respects, an entire contrast to those we have just been considering. The difference of their external covering is obvious to every one; that of the internal structure is not less remarkable.

In this group, animals that are extremely unlike in appearance are associated together. Some like the *Star-fish* (*Fig. 15, 23*), have arms, radiating from a common centre; some like the *Sea-urchin* (*Fig. 24*), are globular and have no arms; and some there are which so resemble worms that they have even been classed as such.

All the animals of this Class are produced from *ova* or eggs, which, in some species at least, are objects of great maternal solicitude. This is evinced in a striking manner by the *Cribella*, a *Star-fish*, which is found on our own shores. The mother, by bending the arms and the lower surface of her body, forms a receptacle, which in its uses may be compared to that of the pouch of the *Opossum* or *Kangaroo*. Here the *ova* are hatched; and for the space of eleven successive days during which this process is going on, the female *Star-fish* has been known to remain with the body bent up, as represented in the annexed figure (*Fig. 20*), and consequently without the power of taking nourishment during that period.

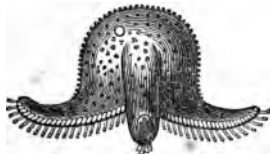


Fig. 20.—EYED CRIBELLA.

In Professor Edward Forbes' "*History of British Star-fishes*," they are arranged in six families. The first of these divisions includes those animals which, in a fossil state, are known as "*stone-lilies*." These beautiful animals were in former periods among the most numerous of the ocean's inhabitants; so numerous, that their skeletons

constitute great tracts of the existing dry land (*Fig. 22*). Now they are of rare occurrence, and in European seas are represented by a species so small that it measures only about three quarters of an inch in length. In this state

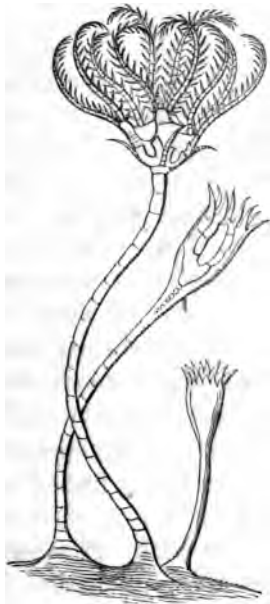


Fig. 21.—POLYPE STATE OF THE FEATHER-STAR (MAGNIFIED).

(*Fig. 21*), it resembles some of the Polypes we have been considering. It is in fact a diminutive, feathery looking star-fish, mounted on a stalk; and wonderful are the changes it undergoes. At a certain period the little animal separates from the stem, and swims freely about. It gradually increases in size, is known as the "Rosy Feather Star," and gives origin to a race of descendants,

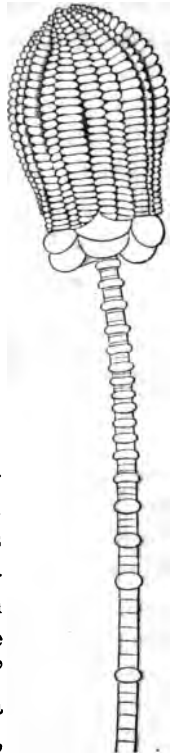


Fig. 22.—STONE LILY.

each of which, in its young state, looks like a plant or a coralline, and attains, when more mature, the free condition of the parent.

The second family consists of those Star-fishes which have a roundish central body, furnished with five long arms, not unlike the tails of serpents (*Fig. 23*). These are merely

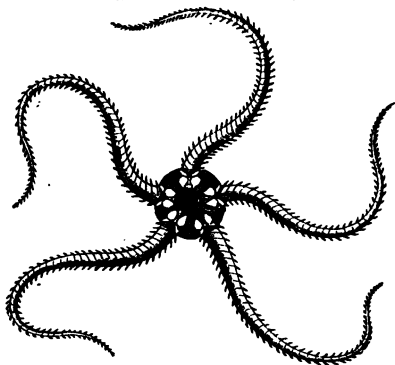


Fig. 23.—STAR-FISH.

arms external to the body, and easily separated from it at the pleasure of the animal, from which circumstance the English name of “Brittle-stars” has been bestowed upon the tribe. Its members differ very much in size and appearance. Some of them measure as much as sixteen inches in diameter; others are so small, that a score or two of them might be displayed on an ordinary visiting-card. Professor Forbes, in speaking of a spine-covered species, remarks:—“Of all our native Brittle-stars, this is the most common and the most variable. It is also one of the handsomest, presenting every variety of variegation, and the most splendid displays of vivid hues arranged in beautiful patterns. It is:

the most brittle of all Brittle-stars, separating itself into pieces with wonderful quickness and ease. Touch it, and it flings away an arm; hold it, and in a moment not an arm remains attached to the body."

To the third family, the common Cross-fish or "Five-fingers" belongs. Each of its arms has deep grooves along its entire length, through which the animal can extend a multitude of little suckers, or tubular organs, which serve as feet to carry it along, and as arms to seize and master its prey. No one can rightly estimate the beauty and singularity of their mechanism, who has not seen them in action. Let any one, when opportunity offers, pick up from the beach one of these animals, which, as it lies upon the sand, left by the retiring waves, appears so incapable of movement, so utterly helpless and inanimate; let him place it in a large glass jar, filled with seawater. Slowly he perceives its arms expand to their full stretch, hundreds of feet are protruded, and each one, as if possessed of independent action, fixes itself to the vessel as the animal begins to march. The numerous suckers are soon all at work, some remaining fixed, while others change their position; and thus the Star-fish, by an easy, equable, gliding motion, changes its place along the bottom, or climbs the smooth sides of the glass in which it is confined.

The members of the fourth family, that of the Sea-urchins, are furnished with spines; and, from the resemblance in this respect to the Hedgehog, the family takes its scientific

name (*Echinidæ*) (*Fig. 24*). Here the arms have disappeared, and the form has become more or less rounded, according to the species. The spines do not grow from the "shell," or, to use a more correct term, the integument, as thorns do on the branches of the common hawthorn. They



Fig. 24.—SEA-URCHIN.*

are attached to little round projections or tubercles, and move upon them in the manner of so many ball-and-socket joints. The Sea-urchins are also furnished with suckers, similar to those described in the Star-fishes; and by the joint action of their spines and suckers, they can move in

* *Fig. 24.*—The spines have been removed from the left side for the purpose of exhibiting the arrangement of the pieces composing the "shell" underneath.

any direction they please, or can moor themselves to the surface of sub-marine rocks.

The outer covering or "shell" of the Sea-urchin is not formed of one piece, as the name would lead us to suppose but of a multitude of pieces accurately fitted together, and which, by a beautiful contrivance, are made to enlarge with the progressive growth of the animal. It is impossible for a rightly constituted mind to contemplate the admirable mechanism of the spines and suckers, and the elaborate structure of the shell, without at once feeling the conviction that in them we behold a portion of "the works of the Lord, and His wonders in the deep." And this feeling increases with the increased minuteness of our examination.

The individuals of the fifth family are not likely to attract the notice of the casual observer. The English term, Sea-cucumbers (*Fig. 25*), gives some idea of their general form.

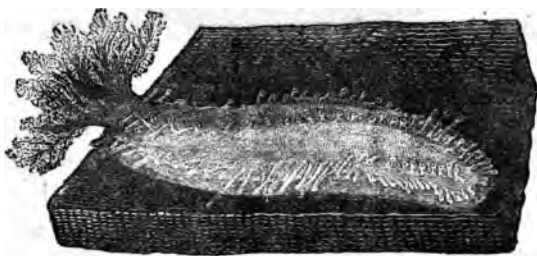


Fig. 25.—HOLOTHURIA.

on them the spines have disappeared; but, as the covering of the body is soft, they can move by the extension or

contraction of its parts, as worms do; and, like the Sea-urchins, they continue to employ the aid of suckers. It is an animal of this kind which the Malays of the Oriental Isles seek so diligently for the supply of the China market, where it obtains a good price when well preserved. It is employed by the Chinese in the preparation of nutritious soups, in common with an esculent seaweed, sharks' fins, edible birds'-nests, and other materials, affording much jelly.

The members of the sixth family, in external appearance, resemble worms; but, from an examination of their internal structure, it is ascertained that they must, in reality, be classed among the Star-fishes. They are not furnished with suckers, and their movement is precisely the same as that which is displayed by worms (*vermigrade*). The English names of Tube-worm and Spoon-worm, have been applied to certain species. Some are found under stones, some burrow in sand, and some select as their mansion an empty univalve shell; their habits, however, are as yet imperfectly known.

ARTICULATED OR JOINTED ANIMALS.

ARTICULATA.

———“Whatever creeps the ground,
 Insect or worm; those waved their limber fans
 For wings, and smallest lineaments exact
 In all the liveries deck'd of summer's pride,
 With spots of gold and purple, azure and green;
 These as a line, their long dimensions drew,
 Streaking the ground with sinuous trace.”—MILTON.

THE Leeches and Worms belonging to this group present to the eye very much the same appearance as the worm-shaped animals which have just been mentioned among the Star-fishes. But an examination of the internal structure shows that they are essentially distinct. The nerves, as may be seen in the annexed figure (*Fig. 26*) of a common insect, are no longer arranged like rays, and the body in many tribes, as the Earth-worm and the Millepede (*Julus*), consists of a repetition of rings or segments. The Articulated Animals are arranged in the following Classes:—



Fig. 26.—NERVOUS SYSTEM
 OF CARABUS.

- I. Leeches, Earth-worms, &c. *Annellata*.
- II. Barnacles and Acorn-shells, *Cirripēda*.
- III. Crabs, Lobsters, &c. *Crustacea*.
- IV. Beetles, Bees, Butterflies, &c. *Insecta*.
- V. Spiders, Scorpions, and Mites, *Arachnida*.

CLASS I.—LEECHES, EARTH-WORMS, &c.

ANNELLATA.

“Her divine skill taught me this,
 That from everything I saw
 I could some instruction draw,
 And raise pleasure to the height,
 Through the meanest object’s sight.”—G. WITHER.

THE most obvious character of the Leech or the Earth-worm is the number of little rings of which the body is composed; and hence the Latin word, which signifies a little ring, suggests an appropriate term for this class of animals.

The medicinal Leech and the common Horse-leech of our ponds are so well known, that every one must, at some period



Fig. 27.—LEECH.

or other, have noticed that either extremity of the body can, at the will of the animal, be used as a sucker, and thus converted into a support or point of attachment. Leeches are of many species; but these peculiar discs or suckers may be regarded as “the badge of all the tribe.”

The medicinal Leech is not a native of Ireland; it is found in some parts of Britain, but is now becoming very rare. It is still seen in the lakes of Cumberland, but even there is

rapidly disappearing. This fact is mentioned by Wordsworth in a stanza, which notices at the same time the manner in which they are collected:—

“He with a smile did then his words repeat;
And said, that, gathering leeches, far and wide
He travelled; stirring thus about his feet
The waters of the pools where they abide.
Once I could meet with them on every side;
But they have dwindled long by slow decay;
Yet still I persevere, and find them where I may.”

Resolution and Independence.

The supply of leeches used in these countries is derived from France, Sweden, Poland, Hungary, the frontiers of Russia, and Turkey, and the great extent of the trade thus carried on may be judged of from the fact, that four only of the principal dealers in London import 7,200,000 annually.

The term *Leech* was applied by our old writers, not only to the animal, but also to persons, both male and female, who were skilful in the art of healing. Thus, in the ancient Ballad of Sir Cauline, the king calls upon the princess to exercise her skill on behalf of the wounded knight:—

“Come down, come down, my daughter deare,
Thou art a leech of skille;
Farre lever had I lose half my landes,
Than this good knight sholde spille.”

The winter is passed by our common horse-leech in a state of torpidity, in the mud at the bottom of the ponds or ditches in which it lives.

The Earth-worms represent another tribe. In them suckorial discs, such as those of the leeches, do not exist; but a mechanical contrivance of a different kind may be observed. The rings, of which their body is composed, are no longer perfectly smooth, but are furnished with small bristles or hooks. These, as the creature pushes its way, catch upon the soil, and form fixed points of support, by which the worm is enabled to maintain its place while drawing forward the remaining parts of the body. Earth-worms move but little abroad during the day-time, except when disturbed. The young are produced from eggs, which, previous to their being deposited by the mother, have undergone a certain degree of development.

The mouth of our common Earth-worm has a sharp proboscis, but is destitute of teeth. The food consists of the decaying particles of animal and vegetable matter, which instead of being dissolved and lost, become thus the means of supporting animal life. The results do not, however, stop here, but extend to birds and fishes, and even to man himself. This did not escape the observation of White of Selbourne, who justly remarks:—

“The most insignificant insects and reptiles are of much more consequence, and have much more influence in the economy of nature, than the incurious are aware of; and are

mighty in their effect, from their minuteness, which renders them less an object of attention, and from their numbers and fecundity. Earth-worms, though in appearance a small and despicable link in the chain of nature, yet, if lost, would make a lamentable chasm. For, to say nothing of half the birds, and some quadrupeds, which are almost entirely supported by them, worms seem to be the great promoters of vegetation, which would proceed but lamely without them, by boring, perforating, and loosening the soil, and rendering it pervious to rains and fibres of plants, by drawing straws and stalks of leaves and twigs into it, and, most of all, by throwing up such infinite numbers of lumps of earth called worm-casts, which, being their excrement, is a fine manure for grain and grass."

Respiration, both in the Leech and in the Earth-worm, is carried on by means of pores and internal sacs. In the "lob-worm," or "lug" of fishermen (*Fig. 28*), a portion of the body is furnished with little tufts, to which the blood is conveyed, and there purified, by coming into contact with the air diffused through the seawater.

In the next tribe of Annelids, a new modification of these organs is exhibited, one admirably



Fig. 28.
ARENICOLA.

adapted to their peculiar habits and modes of life. All the individuals of this assemblage dwell in tubes, consisting either of shelly matter, secreted from their own bodies, or of



Fig. 29.—GROUP OF SERPULÆ.

particles of sand and gravel glued together to serve as a habitation. Under these altered circumstances, the only place to which the vivifying principle of the sea-water could freely have access, would be that near to the orifice of the tubes; and here, accordingly, we find the respiratory apparatus arranged, often extremely graceful in its form, and enriched with brilliant colouring. The small contorted tubes which encrust, in so fantastic a manner, the old bottles or dead shells dredged up from any of our bays, form an example of this group. They are the dwellings of worms bearing the name of *Serpulæ* (Fig. 29). If while the animals are still alive, they be placed in a vessel of sea-water, few spectacles are more pleasing than that which they exhibit. The mouth of the tube is opened by the raising of an exquisitely constructed door, and the beautiful fan-like breathing apparatus is then cautiously extended.

The members of the fourth tribe present, in their habits, a complete contrast to the last. They are formed for loco-

motion, and some among them can swim with considerable swiftness (*Fig. 30*). The roving life they lead has induced

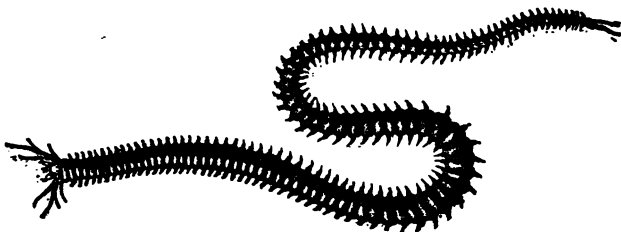


Fig. 30.—*NEREIS*.

Milne Edwards to bestow on them the characteristic appellation of *Errantes*.

In respect to some worms, there are traditionary errors which are still current. Thus, there is a species, called the Hair-worm, which is abundant, during a part of the summer, in rivulets in the North of Ireland and elsewhere. Its length is about eight or ten inches, and the common superstition about it is, that horse-hairs placed in water become vivified, and are changed into these worms. This notion, with the addition that the Hair-worm was the young state of the serpent, was prevalent in the days of Queen Elizabeth, for we find it is thus recorded by Shakspeare,—

———“ Much is breeding,
Which, like the courser's hair, hath yet but life,
And not a serpent's poison.”

Among these humble animals are some which possess luminous properties. One has been observed in Ireland on

some of the extensive tracts of bog; and Mr. R. Ball, when passing at night between the islands of Arran, in the Bay of Galway, had an opportunity of observing a similar power in one of the marine species. As soon as the dredge was let down, a blaze of light flashed from the grass-wrack, with which the bottom was covered; and as the boat was pulled along, "the dredge seemed as if filled with liquid molten silver." On drawing it up, the light was found to proceed from numbers of a very small species of worm, of a bright red colour, and so soft that they could not be taken out of the dredge. By day-light, it is probable, their very existence would have been unnoticed, so little conspicuous were they.

CLASS II.—BARNACLES AND ACORN SHELLS.

CIRRIPEDA.

"There are found in the north parts of Scotland and the islands adjacent, called Orchades, certain trees, whereon do grow certain shells of a white colour, tending to russet, wherein are contained little living creatures; which shells in time of maturity do open, and out of them grow those little living things, which, falling into the water, do become fowls which we call Barnacles."

THESE words occur in Gerardes' "Herbal, or General History of Plants," a work published in 1597; and the statement is given by that author on the authority of others. He then

proceeds in a strain which marks the downright sincerity of this honest and laborious old naturalist, who had mistaken



Fig. 31.—SHELL OF LEPAS.

BARNACLES.



Fig. 32.—BODY OF LEPAS.

the soft parts of the barnacle for a bird. “But what our eyes have seen and our hands have touched, we shall declare. There is a small island in Lancashire, called the Pile of Foulders, wherein are found the broken pieces of old and bruised ships, some whereof have been cast thither by shipwreck, and also the trunks and bodies, with the branches of old and rotten trees cast up there likewise, whereon is found a certain spume or froth, that in time breedeth unto certain shells in shape like those of a mussel, but sharper pointed and of a whitish colour; wherein is contained a thing in form like a lace of silk finely woven, as it were, together, of a whitish colour, one end whereof is fastened unto the inside of the shell, even as the fish of oysters and mussels are; the

other end is made fast unto the belly of a rude mass or lump, which in time cometh to the shape and form of a bird: when it is perfectly formed, the shell gapeth open and the first thing that appeareth is the foresaid lace or string; next come the legs of the bird hanging out, and, as it groweth greater, it openeth the shell by degrees, till at length it is all come forth, and hangeth only by the bill. In short space it cometh to full maturity, and falleth into the sea, where it gathereth feathers, and groweth to a fowl bigger than a Mallard and lesser than a Goose."

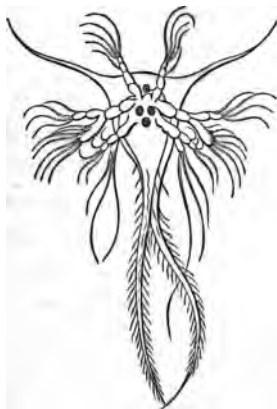


Fig. 33.—YOUNG OF BARNACLE.

We may smile at the extravagance of these ideas, and wonder how fancy could have devised such tales. But the wildest stretch of imagination could not venture upon anything more wonderful than the real and simple facts respecting the transformation of these animals.

Before the shelly covering of that Barnacle was secreted, the creature, not fastened as now by its fleshy stalk, was free and locomotive, with members well adapted for swimming, and furnished with one central eye (*Fig. 33*). The animal of that Acorn-shell, now fixed so immoveably upon the rock, had, at one time, an elliptic figure, two eyes mounted upon footstalks, and six pair

of jointed legs, which, keeping stroke like so many oars, propelled it onwards (*Fig. 34*). At a certain period its erratic habits were laid aside, its future resting-place was selected, and then, attaching itself securely to the place thus chosen, its shelly covering was secreted, and the power of sight, no longer needful for the welfare of the animal, was extinguished for ever.



Fig. 34.—YOUNG OF ACORN-SHELL.

The figures here given (*Fig. 31, 32*) of Barnacles, exhibit the pedicle or stalk by which they are attached to floating pieces of timber; and that of the Acorn-shell (*Fig. 35*) shows the shelly base by which it is fixed to the rock or other body on which it is found. The organs which give to the class the scientific name signifying “curl-footed,” are also represented, so that this peculiarity of structure will be easily understood and remembered. These animals were formerly classed among the *mollusca*, or, to use a more common phrase, the “shell-fish;” but in consequence of a better knowledge of their structure and transformations, they now constitute a distinct class.

The cheapness of the pleasures which natural history affords should of itself form a reason for the general cultivation of such pursuits. They are within the reach of the most humble, and are not dependent on costly apparatus. By means so simple as a glass of sea-water, the *Balani* or Acorn-shells may be made to exhibit a series of movements,

which, when witnessed by the young, call forth expressions of the most unfeigned delight. Let the reader try the experiment. Go at low water to a rock on the beach, choose a few of the oldest and largest limpets, left uncovered by the receding tide, and encrusted with the Acorn-shells. As the



Fig. 35.—BALANUS, OR
ACORN-SHELL.

enclosed animals have then been without nourishment for two or three hours, they will be quite ready for another meal. Throw the limpet shells into a glass of sea-water, and in a minute or two the Acorn-shells upon them will begin to open. Presently a beautiful feathered apparatus (*Fig 35*) will be extended, then withdrawn. It will again be put forth, and again retracted; but with such grace, regularity, and precision, that the eye regards it "with ever new delight." And when the same exquisite mechanism is exhibited by every one of them, and when we consider that it ministers, at the same moment, both to the function of breathing and to the supply of food, a train of ideas is excited, which rises from the humble shell to **HIM** by whom it has thus wondrously been fashioned.

CLASS III.—CRABS, LOBSTERS, SHRIMPS, &c.

CRUSTACEA.



Fig. 36.—THELPHUSA.

THE scientific name of the present class has reference to the shelly crust or covering by means of which the Crab and the Lobster are protected. In the smaller species, it bears a resemblance to horn or parchment.

They all breathe by means of gills or *branchiæ*. The combination of the jointed limbs, respiration by gills, and distinct sexes, constitute the character of the class, Crustacea.

They are universally diffused, not only throughout the ocean, but through ponds, lakes, ditches, and running waters. In the polar seas they are found in great abundance, though the number of species is very limited. In the equatorial regions; while they are no less numerous, they present a

greater variety of form and attain a larger size. There are some species which live at all times on the land, and some come to it as occasional visitors.

Every one who has opened the "shell" of the common Crab has noticed a number of leaf-like organs, regularly arranged into two parcels, with the points of the little leaves or plates in each parcel brought nearly together (*Fig. 37*). These are the gills, organs admirably adapted to the aquatic life of the animal.

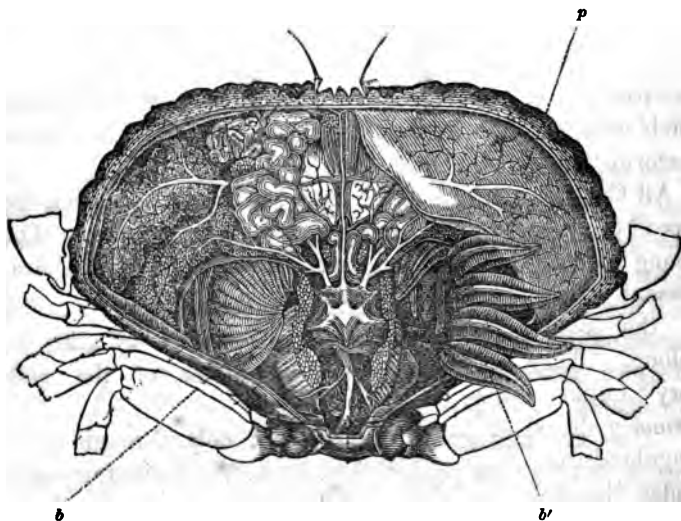


Fig. 37.—Anatomy of Crab.

Fig. 37.—*p*, Part of the lining membrane of the shell.—*b*, Gills in their natural position.—*b'*, Gills turned back to show their vessels.

In the Lobster, the arrangement of these parts is different. In other Crustacea, the gills are formed like feathery tufts, and float freely in the water (*Fig. 38*); while, in those that



Fig. 38.—*SQUILLA*.

live partially or altogether on land, contrivances of different kinds exist to retain so much water as to enable the gills to perform their functions.

All Crustacea are produced from ova or eggs, of which the “pea” of the common Lobster is a familiar example. The young do not, however, on their liberation from the ova, present a miniature resemblance to the species to which they belong. They are, in fact, so very unlike, that they were formerly described as animals of singular form and rare occurrence, under the name of *Zoea*. The annexed figure of one of these (*Fig. 39*) is copied from a Dutch work published in 1778. Five of

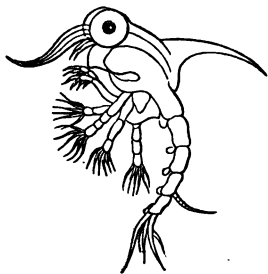


Fig. 39.—*ZOEA* (MAGNIFIED).

them only were known, when in 1822, Mr. J. V. Thomson, to his great surprise, met with *Zoeas* in considerable abundance in the Cove of Cork. Further research showed that these animals, which had been regarded as so rare that the capture of each was recorded as an event, were to be found in vast profusion in our bays and estuaries, and were but the young of the common crabs!

Those who have only seen the common edible crab (*Cancer pagurus*, Fig. 41) in its mature condition, will perhaps be surprised to learn that it existed at one time under the form represented in Fig. 40, its members being adapted for swimming, and its body so minute that its natural size, when in that state, is shown by the speck adjoining the letter *n*.

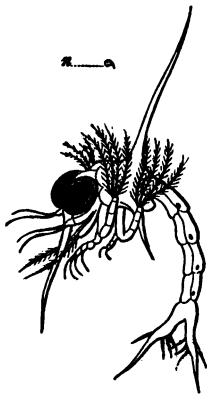


Fig. 40.—YOUNG OF THE
COMMON CRAB.

All the crustacea possess the capability of reproducing extremities which are injured. Thus, if the leg of a crab be fractured, it throws off the injured limb, near to the body. The bleeding then stops, and a new limb is gradually developed. Another provision exists by which the growing animal throws off its "shell" and is supplied with one of larger dimensions. In two or three days the new covering assumes the hardness of the old one; and, until then, the animal, as if conscious of its defenceless state, avoids, as much as possible, all exposure.

The mouth in some crustacea is formed for suction, in others for mastication. Some have the eyes mounted on footstalks; in others the footstalk is absent. Again, some have the gills enclosed in the body, and have ten legs; others have the gills external, and the number of the legs or appendages variable. By such characters they are divided into sections, orders, sub-orders, genera, and species.

The crabs used as food are, of course, those which are most valued and sought after. The large edible crab is that which, in the North of Ireland, is known as *the* crab (*Fig. 41*). It is distributed round all our coasts, and is generally taken by wicker-baskets, like the cage-shaped wire mouse-traps, and baited with guts of fish or other garbage; but it is also taken by means of a piece of hooked iron thrust into its retreats at low water.

The smaller edible crab of British authors is the most common species round the entire coasts of Great Britain and Ireland, lurking beneath stones or tangle, or half concealed in the moist sand. We learn from Leach that this species "is sent to London in immense quantities, and eaten by the poor, who esteem it a great delicacy." It is



Fig. 41.—CANCER PAGURUS.

used in like manner in Paris, but is never offered for sale in the markets of the North of Ireland.

The Pea-crabs form an interesting group, from their diminutive size, and their singular habitation in those shells which, like the cockle, are composed of two pieces, or valves. One of these was celebrated in connexion with the Crab; as,

“The anchored Pinna and her cancer friend.”

The Pinna, according to tradition, being warned of the approach of danger by the alacrity of the little Crab, who was the joint and friendly occupant of her mansion. Two and even three Crabs are occasionally found in one mussel or one pinna.

The hermit-crabs belong to a different order. The tail is prolonged and soft, and hence, in self-defence, the animal is obliged to occupy some univalve shell, which has been deserted by its original occupant. When thus in search of a dwelling-house, it is said to present an amusing spectacle as it inserts the tail successively into several shells until one is found to fit. From the fact of each Crab being the solitary inmate of its retreat, the common English name has no doubt been bestowed.

In the Crustacea of the next order, the tail is not only longer but is different in form, being divided into five broad flat pieces, so as to act with great effect upon the water. The common Lobster is perhaps the best known example; it is taken all round the rocky portions of the coast.

Another species the Spiny Lobster (*Fig. 42*), attains

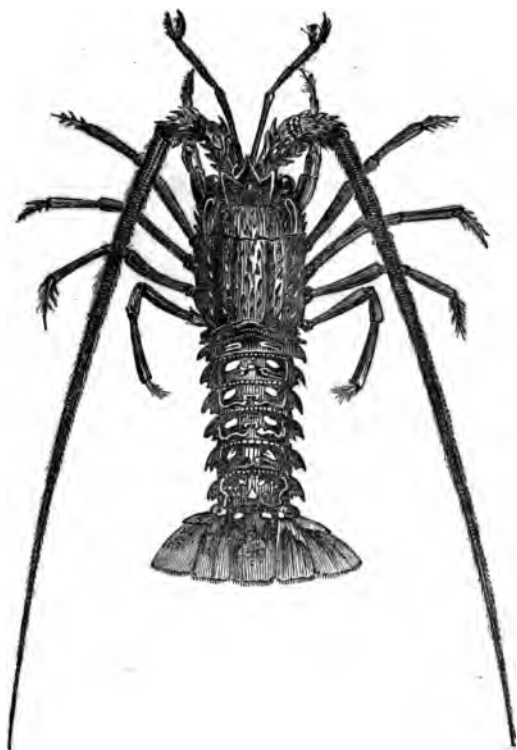


Fig. 42.—SPINY LOBSTER (REDUCED).

even larger dimensions, being occasionally taken of eighteen or twenty inches in length, and weighing so much as twelve

or fifteen pounds. It frequents deep water, and only approaches the shores in spring, for the purpose of laying its eggs.

The Cray-fish (*Fig. 43*), which is an inhabitant of rivers,



Fig. 43.—CRAY-FISH (MAGNIFIED).



Fig. 44.—SAND-HOPPER (MAGNIFIED).

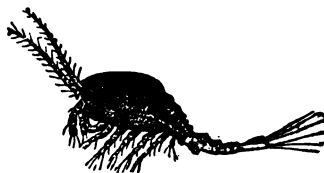


Fig. 45.—CYCLOPS (MAGNIFIED).

the Sand-hopper (*Fig. 44*), which frequents the moist margin of the Sea-beach, and the little Cyclops (*Fig. 45*), which lives in ponds and ditches in our fields, furnish examples of the

variety of situation in which the Crustacea are to be found. Another tribe which has not yet been mentioned is to be sought for in the skin, the eyes, and the gills of fishes, and other marine animals. These creatures, like the *Entozoa*, are parasites; but because they are not found in but upon other animals, they are spoken of by some naturalists under the name *Epizoa* (Fig. 46).

All of those yet enumerated are aquatic; but the land-crabs of the Antilles and of India furnish us with examples of species very different in both structure and habits. "All the grass through the Deccan," says Bp. Heber, "usually swarms with a small land-crab, which burrows in the ground, and runs with considerable swiftness, even when encumbered with a bundle of food almost as big as itself; this food is grass, or the green stalks of rice, and it is amusing to see the crabs sitting, as it were, upright, to cut their hay with their sharp pincers, then waddling off with their sheaf to their holes as quickly as their sidelong pace will carry them." Col. Sykes states that another species is abundant along the Ghats in India, and also on the most elevated table-lands, intruding themselves into the tents, and even invading such beds as are placed on the ground. In one place, at an elevation of 3,900 feet above the level of the sea, their burrows render it unsafe to ride over many parts of the mountain.



Fig. 46.—LERNEÆ
(MAGNIFIED).

CLASS V.—INSECTS.

INSECTA.

“The insect youth are on the wing,
 Eager to taste the honied spring,
 And float amid the liquid noon:
 Some lightly o’er the current skim,
 Some show their gaily-gilded trim,
 Quick-glancing to the sun.”—GRAY.



Fig. 47.
 SCOLOPENDRA.

THE word insect is derived from a Latin term signifying cut or notched, the body being deeply cut into segments. In the lower tribes the segments of the body are numerous (*Fig. 47*), and in some cases so many as sixty or eighty pairs of legs may be counted on one individual. In the true insects, on the contrary, the body consists of three portions,* and the legs are six in number (*Fig. 48, 49*). They breathe by means of small orifices placed along the sides, and communicating with tubes which divide into innumerable branches, and convey the air to every part of the body.

With regard to the external senses, it is generally allowed that Insects possess those of touch, taste, and smell. That of hearing was formerly denied to them, even by distinguished naturalists.

* These are the head, the *thorax* or chest, and the *abdomen*.

Shakspeare entertained a different and more correct opinion, when he used the words,—

“I will tell it softly;
Yon crickets shall not hear me.”

On this point the observations of Brunelli, an Italian naturalist, are quite conclusive. Several of the field-crickets which he kept in a chamber continued their crinking song through the whole day; but the moment they heard a knock at the door they were silent. He subsequently invented a method of imitating their sounds, and when he did so outside the door, at first a few would venture on a soft whisper, and by-and-by the whole party burst out in a chorus to answer him; but upon repeating the rap at the door, they instantly stopped again as if alarmed. He likewise confined a male in one side of his garden, while he put a female in the other at liberty, which began to leap so soon as she heard the crink of the male, and immediately came



Fig. 48.—ICHNEUMON.



Fig. 49.—CALOSOMA.

and immediately came

to him—an experiment which he frequently repeated with the same result.

There are some insects in which no organs of vision have been discovered; but in general they are not only very obvious, but present considerable variety in colour, form, position, and structure. The most usual number of eyes is two; but when it is needful that the insect should, at the same time, have the power of observing objects in the air and in the water, it is gifted with four eyes, as in the common Whirl-gig (*Gyrinus*, *Fig. 50*), which may be seen performing its rapid evolutions on our ponds and streamlets.



Fig. 50.—
GYRINUS.

The eyes are sometimes simple, but the most common kind is that which is termed compound. Such eyes, when separated and made clean, are as transparent as crystal. Their number is extremely variable, and cannot but strike the most indifferent with astonishment. “What would be thought of a quadruped whose head, with the exception of the mouth and place of juncture with the neck, was covered by two enormous masses of eyes, numbering upwards of 12,000 in each mass? Yet such is the condition of the organs of vision in the Dragon-fly.” By this beneficent arrangement, the want of motion in the eyes is more than counterbalanced by the abundance in which these organs are bestowed.

No one circumstance, connected with insects, has perhaps arrested the attention of ordinary observers so much as what

is termed their metamorphoses. The higher animals retain through life, with some variations in size and colouring, very much the same forms which they had at birth. Insects, on the contrary, pass through four states of existence, and these are in general distinctly marked. They are first contained in eggs, which are deposited by the parent in suitable situations, and with a degree of instinctive care which fills us with admiration. They then become active and rapacious, and are well known by the names of grubs, maggots, and caterpillars, according to the tribes to which they belong (*Fig. 51*). To this condition Linnæus applied the Latin word *larva* (a mask), as if the perfect insect were masked or concealed in the figure of the caterpillar. The ravages of which the forester and the gardener complain, result most generally from the voracity of insects in their larva state. They eat much, increase rapidly in size, change their skins several times, and pass into another state, in which, in some tribes, all appearance of vitality is for a time suspended. The caterpillar of the butterfly or moth, when the time for this change arrives, seeks out a secure asylum for its period of helplessness, and suspends itself by a thread (*Figs. 52, 54*), envelopes itself in silk, makes a covering of leaves, or entombs itself in the earth, according to the habits of the species. Some of them in this state appear, on a miniature scale, like Egyptian mummies, or like an infant wrapped up in swaddling-clothes. From this peculiarity the term *pupa* (a baby) has been given to them; and *chrysalis*, a word of Greek



Fig. 51.—LARVA OF PAPILIO MACHAON.

Fig. 52.—CHRYSALIS
OF VANESSA.Fig. 53.—
VANESSA.Fig. 54.—PUPA OF
MACHAON.

Fig. 55.—IMAGO OF PAPILIO MACHAON.

origin, referring to the bright or golden colours which some of them display, has also been applied. In all cases these terms indicate the form which the insect presents immediately before its appearance in the last and perfect form;—that which is termed the Imago (*Figs. 53, 55*), as though it had not until then its perfect or fully developed image. All insects, however, do not assume this quiescent state. The young of the common Gnat pass the early stages of their existence as inhabitants of the water, jerking about with great agility, or swimming with ease and swiftness. The Crickets and Cockroaches are as active and lively at this period of their lives as at any other, and differ in appearance from the perfect insect only in the absence of wings.

There is no animal or vegetable substance which does not furnish food to one or more species of insects. Some live entirely on putrifying substances, and, by removing them, help to maintain the purity of our atmosphere. Others prey on those that are weaker than themselves; some feed upon timber; others upon leaves and grass; some, like the “worm i’ the bud,” feast on our loveliest flowers; and others revel on the nectar of our choicest fruits.

From the great variety of their food, there must be a corresponding variety in the instruments by which the food is taken, and accordingly we find the mouth is sometimes furnished with jaws for cutting solids, and at others with tubes for sucking up fluids. When all the parts are present, as in the common rapacious Beetles (*Fig. 56*), the mouth

consists of seven parts (*Fig. 57*). These are, an upper lip (*a*); a lower lip (*d*), a tongue, two upper jaws (*b*), and two lower jaws (*c*). The motion of the jaws is not vertical, as in the vertebrate animals, but is horizontal; and the lower jaws are

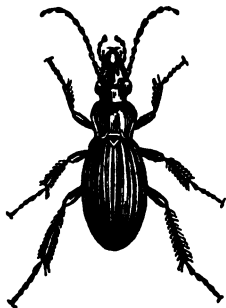


Fig. 56.—CARABUS.

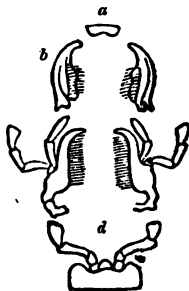


Fig. 57.—PARTS OF MOUTH OF CARABUS.

sometimes employed in holding the food, which the upper jaws or *mandibles* are engaged in cutting to pieces. In some orders the seven parts are not to be seen with such distinctness, some of them being prodigiously enlarged, and others diminished, or perhaps altogether wanting.

To bring organs which are so variously constructed fully into play, it is necessary that each insect should possess the power of transporting itself with ease to whatever situation its necessities require, and that it should be furnished, for this purpose, with organs of flight adapted to the varying circumstances and requirements of the several tribes. These wings never exceed four in number. In beetles of burrowing habits

the upper pair is hard and horny, and serves to protect the softer membranous pair when not in use. In other tribes the wings resemble the finest lace; and in the butterflies and moths they are covered with a mealy substance, which examination under a lens shows to be composed of the most delicate scales, differing in form, in size, and in colouring, and giving to some of them the gorgeous metallic tints for which they are so remarkable.

“The grand and characteristic endowment of an insect,” says Professor Owen, “is its wings. In no other part of the



Fig. 58.—DRAGON-FLY.

animal kingdom is the organization for flight so perfect, so apt to that end, as in the class of insects. The swallow cannot match the dragon-fly (*Fig. 58*) in flight. This insect has been seen to outstrip and elude its swift pursuer of the

feathered class: nay, it can do more in the air than any bird; it can fly backwards and sidelong, to right or left, as well as forwards, and alter its course on the instant without turning."

From the great importance of the wings, and from the modifications in their structure, they become naturally the basis for classification, and enable us to arrange the various insect tribes in nine Orders. To each of these our attention may now be briefly directed.

ORDER I.—BEETLES.

COLEOPTERA (SHEATH-WINGED).

AMONG the various tribes of beetles constituting the present order, very great difference exists, even in our native species, in size and colouring. The great Water-beetle is sufficiently powerful to play the tyrant of the pool in which he lives, and even to attack and overcome small fishes. Others, again, are so minute, as to live in the perforations they make in the timber of our dwelling-houses, and thus to escape detection by ordinary observers. Among the latter may be mentioned those little beetles (*Fig. 59*), to which vulgar superstition has given the name of "Death-watch."

"The solemn Death-watch click'd the hour she died."—GAY.

This sound, which is only the call of the insect to its companion, so exactly resembles the ticking of a watch, that Mr. R. Ball, by placing his watch to the wainscot which the little

beetle frequented, has caused the insect to respond to its ticking.

In many beetles, the wing-cases (*elytra*) are united together, and, as wings could not be used, they are not given. In the glow-worm (*Fig. 60, 61*), an insect not found in



Fig. 59.
PTINUS (MAGNIFIED).

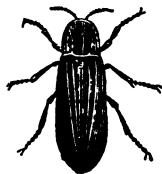


Fig. 60.
MALE GLOW-WORM.



Fig. 61.
FEMALE GLOW-WORM.

Ireland, the female, being soft and wingless, does not seem to belong to the present order; but the male is possessed of wing-covers, and of expansive wings, by means of which he is enabled to shape his course to the light displayed by the more stationary female.

The "droning-flight" of the Dor-beetle, heard in the twilight of the summer-evening's walk, is a sound with which every one is familiar; and equally well known is the manner in which the creature startles us from our reveries by striking against our faces. It is from this circumstance, and not from any absence of the sense of vision, that its common epithet, the "blind-beetle," has been derived. To this family belongs the sacred beetle of the Egyptians (*Fig. 62*), whose image remains sculptured on many of their obelisks

and other monuments. It still attracts the attention of travellers, from its habit of collecting and rolling about a ball of dung, in which it deposits an egg.

As a contrast in habits to this beetle, may be mentioned the *Cicindela* (*Fig. 63*), which is regarded as one of the tigers of the insect tribes. Its colour is a golden green, with



Fig. 62.—SACRED BEETLE OF
THE EGYPTIANS.



Fig. 63.
CICINDELA.

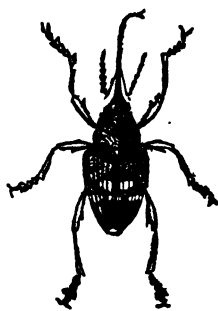


Fig. 64.
NUT WEEVIL (MAGNIFIED.)

white or yellow spots, and it appears particularly rich when the insect is running rapidly along in the bright sunshine of a summer's day. Other species carry on their operations so as to escape our notice. Thus the Nut-weevil (*Fig. 64*), with her long horny beak, drills a hole through the shell while it is yet soft, deposits an egg in the nut, and, at the same time, furnishes her future offspring with a house for its defence, and food for its support.

ORDER II.—CRICKETS, LOCUSTS, ETC.

ORTHOPTERA (STRAIGHT-WINGED).

THIS division includes in it the cockroaches, crickets, grasshoppers, and locusts, and those very strange-looking creatures, from tropical countries, which have been by common consent, named 'walking-sticks' and 'leafinsects.' Some species of the latter, which we see in our museums, have the wing-covers of so bright and fresh a green, that we can with difficulty persuade ourselves we are looking on an

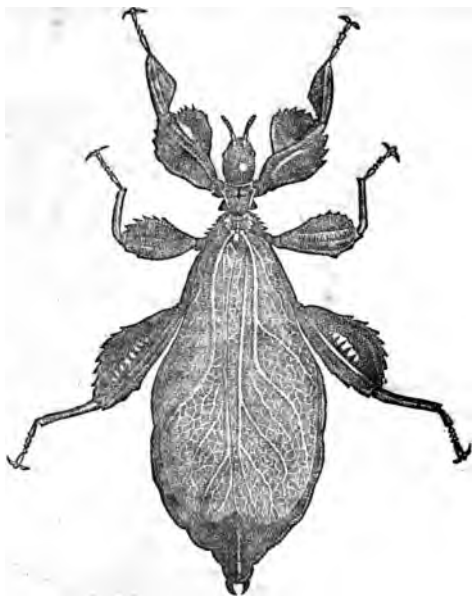


Fig. 65.—LEAF-INSECT.

insect; while others present a no less striking resemblance to the colour of the leaf, and its delicate network, as it lies on the ground in its withered state (*Fig. 65*).

One foreign insect deserves mention, because it has obtained from its attitude the name of the “praying Mantis” (*Fig. 66*); and popular credulity, both in Europe and Africa, has gone so far as to assert, that a child or a traveller, who has lost his way, would be guided by taking one of these pious insects in his hand, and observing in what direction it pointed. They have the character of being gentle, while in



Fig. 66.—MANTIS.

reality they are extremely ferocious; and by using one of the fore-legs as a sabre, they can cut off the head of an antagonist at a single stroke.

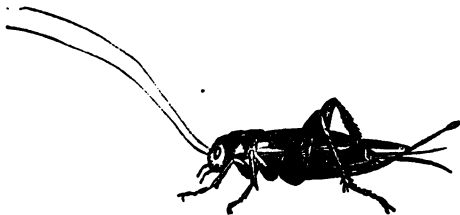


Fig. 67.—HOUSE-CRICKET.

Perhaps in these countries no individual of the order is so well known as the House-cricket (*Fig. 67*), which common belief regards as foretell-

ing cheerfulness and plenty. It would be more correct to

say, that, as crickets feed on the crumbs, the milk, the gravy, and all the waste and refuse of a fireside, their presence does not prognosticate that plenty is to come, but that it already exists. None of our poets have offered to this insect a more graceful tribute than Cowper:—

“Thou surpassest, happier far,
Happiest grasshoppers that are;
Theirs is but a summer’s song,
Thine endures the winter long,
Unimpaired, and shrill, and clear
Melody throughout the year.”

There is one insect belonging to the present order, whose very name—the locust—(*Fig. 68*) is associated with terror and devastation. The description given by the Prophet Joel, of their power, is not less remarkable for its fidelity than its grandeur: “A fire devoureth before them, and behind them a flame burneth: the land is as the Garden of Eden before them, and behind them a desolate wilderness; yea, and nothing shall escape them.

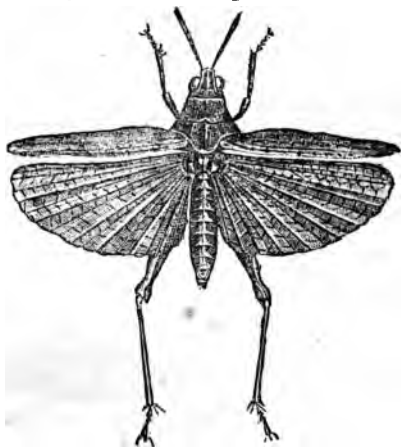


Fig 68.—LOCUST.



Like the noise of chariots on the tops of mountains shall they leap, like the noise of a flame of fire that devoureth the stubble, as a strong people set in battle array."

ORDER III.—DRAGON-FLIES, ETC.

NEUROPTERA (NERVE-WINGED).



Fig. 69.—INDIAN LIBELLULA, OR DRAGON-FLY.

THIS order of insects includes the Dragon-flies, the Lace-winged flies, the Ephemera, and the destructive Termites, or white ants. They have, in their perfect state, four large-sized wings, equal in size, and presenting, in some species, an appearance of the most delicate network. Here also are placed the May-flies, whose larvæ are the well-known case-worms, or caddis-worms, of our streams and ditches (*Fig. 71*).

No one who looks upon any of our native Dragon-flies (*Fig. 58*) hawking over a pond on a bright summer day, and marks the facility with which their insect prey is taken and

devoured, could ever suppose that these swift-flying creatures, had, but a few weeks before, been inhabitants of the water. Yet it is there the early stages of their life are passed, for in that element are the eggs deposited by the mother.

Some have the wings expanded horizontally when at rest (*Fig 58, 69*); others have them closed and erect (*Fig. 70*); but in both, the movements of the insects are so light and graceful, their colours so splendid, and, at the same time, so varied, displaying the softest green and the richest azure, that our neighbours, the French, have bestowed on them the appellation of “demoiselles;” and one of our poets has applied to them a corresponding term:—

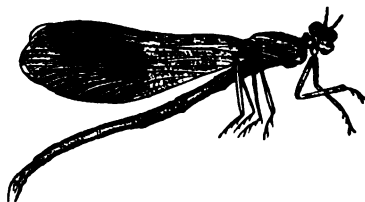


Fig. 70.—AGRION.

“Chasing, with eager hands and eyes,
The beautiful blue *damsel* flies,
That fluttered round the jasmine stems
Like winged flowers or flying gems.”—MOORE.



Fig. 71.—CADDIS-WORMS.

ORDER IV.—BEES, WASPS, ANTS, ETC.

HYMENOPTERA (MEMBRANE-WINGED.)

THE insects of this order have four veined membranous wings, but they are not equal in size, nor do they present the appearance of delicate network as in the preceding order. The female is furnished either with a sting, or with an instrument termed an *ovipositor* (*Fig. 74*), used in the deposition of the eggs. The jaws are powerful, and the tongue, instead of being small and inconspicuous, becomes in some tribes an organ of great size and importance. To this order belong the Saw-flies, Gall-flies, Ants, Wasps, and Bees.

The Saw-flies (*Fig. 72*) take their name from a pair of saw-like instruments, with which the female is furnished, and which she employs for making an incision, in which she deposits an egg.

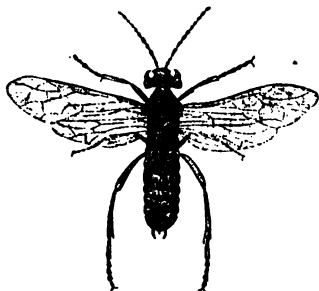


Fig. 72.—TENTHREDO.

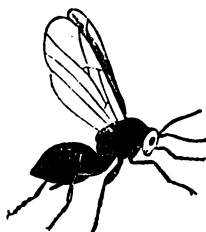


Fig. 73.—GALL-FLY.

The Gall-flies (*Fig. 73*) are those which puncture plants, and, in the wound thus made, insert one of their eggs along

with an irritating fluid, the action of which upon the plant produces tumours or galls of various sizes, shapes, and colours. That found on the wild rose, and called the beguær or bedeguær of the rose, is well known.

In the next division (*Fig. 74*) we find the insects depositing their eggs, not on the leaf or stem of a tree, but actually in the body of a living caterpillar. About three thousand of these Ichneumons, as they are called by Linnæus, are at present known and described. They all deposit in living insects, chiefly while in the larva state, sometimes while pupæ, and even while in the egg state, but not, as far as is known, in perfect insects. The eggs thus deposited soon hatch into grubs, which immediately attack their victim, and in the end ensure its destruction.

We now enter upon the examination of those insect tribes which congregate into large and well-regulated communities, and in which new powers and instincts are developed. Among these are the Ants; and it may perhaps seem strange that the little, busy, wingless creatures, which we see foraging about our fields and gardens, with ceaseless activity, should be included among insects having four membranous

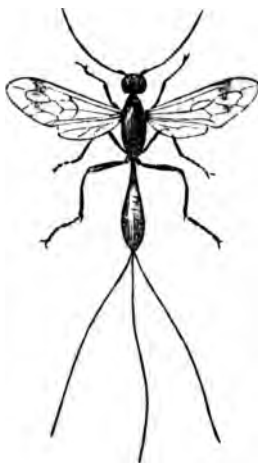


Fig. 74.—ICHNEUMON.

wings. But, if an Ant's nest be examined towards the end of summer, numbers of them will then be found possessed of these appendages. These are young Ants, which have just assumed the perfect state. The males and females rise together into the air; the males soon perish: some of the females retire to their original home, and others, casting their wings aside, become the solitary founders of industrious and populous cities. On the neuters devolve the erection of the store-houses, the making of the highways, the nursing of the young grubs, the catering for all, and many other offices essential to the well-being of the community.

The fact, now ascertained, that our Ants pass the winter in a torpid state, is contrary to popular belief. The prevailing notion is, that during the summer and autumn, they sedulously lay up a stock of provision for the winter, one end of each grain being carefully bitten off, in order to prevent germination. This idea, current but erroneous, is embodied in the following extract from Prior:—

——“Tell me, why the Ant
In summer's plenty, thinks of winter's want?
By constant journey, careful to prepare
Her stores, and bringing home the corny ears—
By what instruction does she bite the grain?
Lest, hid in earth, and taking root again,
It might elude the foresight of her care.”

The error, in this instance, had probably arisen from the ants having been observed carrying their young about in

the state of *pupæ*, at which time they bear some resemblance, both in size and shape, to a grain of corn; and it would receive confirmation from their being occasionally seen gnawing at the end of one of these little oblong bodies—not to extract the substance of the grain, or to prevent its growth, but in reality to liberate the enclosed insect from its confinement.

The fact that no European species of Ant stores up grain, no way affects the lesson which Solomon so beautifully inculcates:—"Go to the Ant, thou sluggard, consider her ways and be wise; which having no guide, overseer, or ruler, provideth her meat in the summer, and gathereth her food in the harvest." Even if the insect did not collect a supply of food for future use, we might all, with great advantage, "consider her ways and be wise." But it is more than probable that Solomon referred to species living in a warmer climate, and, consequently, different in modes of life from those which are natives of these countries. This view is corroborated by the discovery made by Colonel Sykes, of a species living in India, which hoards up in its cell the seeds of grass, and takes the precaution of bringing them up to the surface to dry, when wetted by the heavy rains peculiar to the country.

The Wasps constitute another tribe of Hymenopterous insects. Their community consists of males, females, and neuters. The males and females are produced only towards autumn; the males and neuters die as the season

advances, and each of the widowed females who survives comes forth in spring, an isolated being, to establish another city not less populous than that which has perished.

It is a singular fact, that the nests of these insects are made of a material which we are apt to regard as a modern

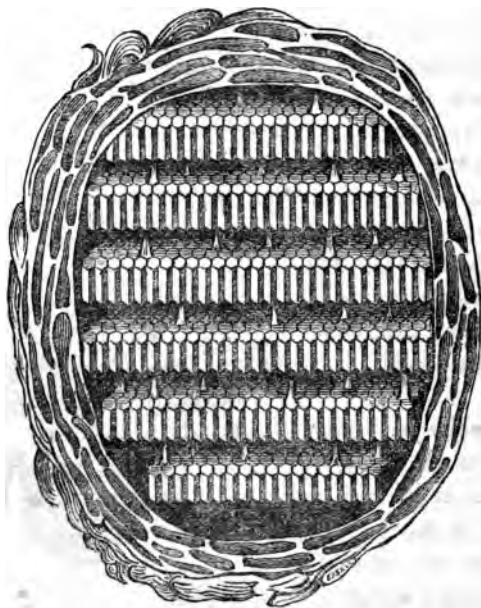


Fig. 75.—INTERIOR OF WASP'S NEST.

invention—paper. With their strong jaws they cut or **tear** off portions of woody fibre, reduce it to a pulp, and, of **the**

papier maché thus fabricated, the cells, and often the covering of their habitations, are formed. The exterior of the tree-nests of some of the foreign species is perfectly white, smooth, and compact, resembling in appearance the finest paste-board. The nest of our common Wasp is less attractive; but when it has been carefully dug out of the earth, and the interior laid open to view, with its layers of cells skilfully supported upon ranges of suitable pillars, the regularity and perfection it displays, cannot be contemplated without feelings of surprise and admiration (*Fig. 75*).

Some Bees are solitary and some are social, their habits in this particular resembling those of the Wasps. Among the solitary Bees, some are known as masons, carpenters, or upholsterers, according to the nature of their labours, and the materials with which they work.

The Social Bees have, in each community, three kinds of individuals—males, females, and workers, or neuters; and, among other peculiarities, they are distinguished from the solitary species by the secretion of the wax of which the cells are constructed. The humble bees, composing the genus *Bombus* (*Fig. 76*),

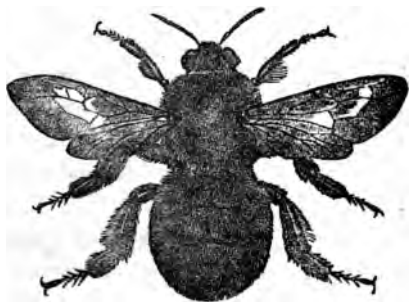


Fig. 76.—*BOMBUS* OR HUMBLE BEE.

are known by their large size and hairy bodies, often of a black colour with orange bands. They form societies, consisting of about fifty or sixty individuals, and occasionally amounting to two or three hundred.

The Hive-bee is, however, the species to which above all others our interest attaches; the accompanying figures of the drones and workers (*Fig. 77, 78*) convey an idea of



Fig. 77.—DRONE BEE.



Fig. 78.—WORKER BEE.

their difference in regard to size and form. The one female, to which we give the name of queen, had always a male epithet applied to her by the ancients.

On the workers the business devolves of collecting honey and pollen, constructing cells, tending the young, and performing all the multiplicity of duties which the common welfare demands. The drones or males take no part in the labours of the hive; and when the continuance of the community is secured, they are dragged forth in the autumn, and mercilessly stung to death by the workers.

The tongue of the bee (*Fig. 79*) is furnished with numerous muscles, and protected by sheaths when not in use, yet fitted

for being instantly unfolded, and darted into the blossoms of a flower. The nectar thus swept up, is at once consigned to the honey-bag. This being done, the tongue is sheathed with the same rapidity, part being drawn back into the mouth, and the remainder doubled up under the chin and neck, until again required.

The little pellets which we see the Bees carrying home on their hind legs, consist of the pollen or farina of flowers. Shakespeare has, therefore, given utterance to the common, but incorrect idea, when he uses the words,

“Our thighs are packed with *wax*.”

The pollen, when brought home, is mixed with honey, and forms what is called Bee-bread. The wax itself is not collected from flowers, but is secreted by means of peculiar organs, which may easily be seen by pressing the hinder portion of the body. It is not a secretion which is constantly going on, but takes place only when required for the construction of comb. To supply it, the wax-workers, which are distinct from the nurses, are obliged to feed on honey, and remain inactive, generally suspended from the top of the hive, for about twenty-four hours previous to the deposition of the wax.



Fig. 79.
TONGUE OF BEE.

ORDER V.—STYLOPS.

STREPSIPTERA (TWISTED-WINGED).

THIS order consists of only a single family (*Fig. 80*). The individuals composing it are short-lived, diminutive in size,

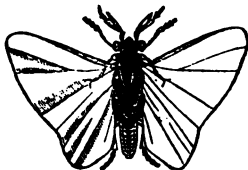


Fig. 80.—STYLOPS (MAGNIFIED).

not exceeding a quarter of an inch, and pass the early stages of their existence as parasites in the bodies of Bees and Wasps, especially in those of different species of solitary bees.

ORDER VI.—BUTTERFLIES, ETC.

LEPIDOPTERA (SCALE-WINGED).

THE wings are four in number, large, extended, covered on both sides with minute scales, overlapping each other like the slates on the roof of a house; and on their removal showing that the wing itself is membranous. There is a pretty little Moth (*Fig. 81*), which might, at first sight, appear to have a greater number of wings; but they



Fig. 81.—PLUMED MOTH (MAGNIFIED).

are regarded as four wings only, cut into a number of longitudinal or feather-shaped pieces, so as to resemble a plume or fan.

In expanse of wing, and beauty of colouring, they stand unrivalled. Some foreign species measure, when expanded, not less than nine or ten inches; and others display tints so splendid, that they have been compared to those of gems and flowers.

Even in those which are natives of our more northern clime, considerable diversity exists. Some are scarcely distinguishable from the leaves of the plants, or the trees on which they repose (*Fig. 82*); others vie in purity with the snow-flake. Some exhibit brilliant metallic hues; and others an azure like that of a summer sky at noon.



Fig. 82.—OAK-LEAF MOTH.

They have been divided, according to the times of their appearance, into those that fly during the day, those that appear in the twilight, and those that come forth at night. These three groups are popularly known as Butterflies, Hawk-moths, and Moths.

Many of the most splendid British Butterflies are not found in Ireland; and several species—as, for example, the Peacock Butterfly—(*Fig. 83*), are taken in the South of

Ireland, but are quite unknown in the North. Hence, as certain kinds have but a limited range, each change of place brings fresh objects of interest before the eye of the naturalist; and as the appearance of different species is periodical, a similar gratification is connected with each change of season.



Fig. 83.—PEACOCK BUTTERFLY.

Those of the second group, which fly most generally in the cool of the morning or evening, have the swiftest and most powerful flight; hence the name Hawk-moths (*Fig. 84*). They are also called Sphinxes, in consequence of the head of the caterpillar being held erect, so as to give it some resemblance to the attitude of the Egyptian Sphinx. Some of the tribe come forth in the brightest sunshine, and have obtained the name of humming-bird hawk-moths. One very remarkable, both for its size and markings, is the Death's-head Moth, the largest of all European species. By the

ignorant it has always been regarded with superstitious terror, as the precursor of war, pestilence, and famine.

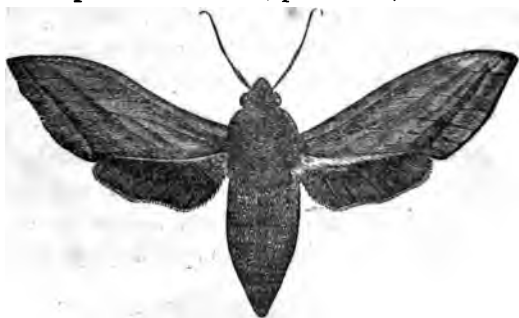


Fig. 84.—SPHINX OF THE VINE.

The remaining tribes are all included under the common name of “moth.” The word is sometimes used to express the extreme of littleness. To show how inaccurate is this



Fig. 85.—EMPEROR MOTH.

idea of their diminutive size, it is only necessary to mention, that the Oak-moth measures three inches and a half across the expanded wings, and the Emperor-moth (*Fig. 85*) is of equal dimensions.

To such species, the lines of Spencer are strictly applicable:—

“The velvet nap which on his wings doth lie,
The silken down with which his back is dight,
His broad outstretch’d horns, his airy thighs,
His glorious colours, and his glistening eyes.”

There is one insect belonging to the present order which may be said to influence the habits and employments of many hundred thousands of human beings; it is the Silkworm moth (*Fig. 88*) whose caterpillar (*Fig. 86*) spins the

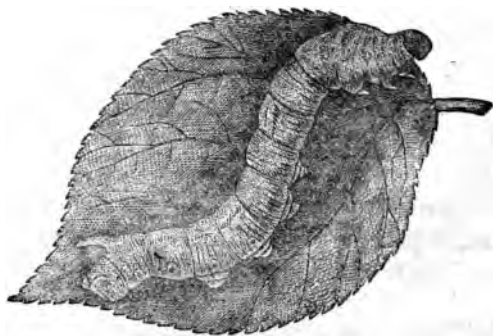


Fig. 86.—SILKWORM.

cocoons from which silk is manufactured. There was a time when this article, now so abundant, was valued in Rome at its weight in gold, and the Emperor Aurelian refused his Empress a robe of silk because of its dearness. At that very period the Chinese peasantry, amounting in

some of the provinces to millions in number, were clothed with this material; and both there and in India it has formed, from time immemorial, one of the chief objects of



Fig. 87.—CHRYSA LIS
OF SILKWORM



Fig. 88.—SILKWORM MOTH.

cultivation and manufacture. About the year 550 the eggs were brought to Constantinople, thence they were introduced into Italy, and under the auspices of Henry IV. of France, the cultivation of silk was commenced in his dominions. In its various states it now forms in many parts of the world a branch of manufacture and commerce, of such extent and importance, that it has been justly remarked, that, when nature

—“Set to work millions of spinning worms,
That in their green shops weave the smooth-haired silk,
To deck her sons”—

“She was conferring on them a benefit scarcely inferior to that consequent upon the gift of wool to the fleecy race, or a fibrous rind to the flax or hemp-plants.”

ORDER VII.—CICADÆ, BUGS, ETC.

HEMIPTERA (HALF-WINGED).

IN the insects belonging to this order the mouth is formed for sucking the juices of animals or plants (*Fig. 89*). The



Fig. 89.—PENTATOMA
(LOWER SURFACE).*



Fig. 90.—HALYS
(UPPER SURFACE.)

wings are four in number, partly overlapping each other, and with the portion towards the base of each tougher than the other, which is membranous.

* This figure exhibits the shape and jointed structure of the proboscis, and its position when not in use. The legs and antennæ are represented as cut off near the base.

In this order is included the Cicada (*Fig. 91*), celebrated for his song, and whose images made of gold were formerly worn by the Athenians in their hair.

Every pond affords examples of other insects whose structure exhibits, in a more obvious manner, the characteristics of the order. There we find the Boat-fly (*Fig. 92*), which rows gracefully along upon its back; and the Water-scorpion (*Nepa, Fig. 93*), in which the dark external covering of our most common native species, contrasts beautifully with the scarlet body underneath; and others which glide rapidly along, or perform a more unusual feat—that of walking upon the surface of the water.

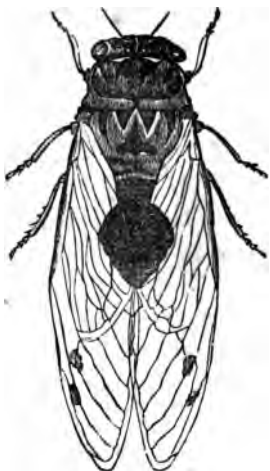


Fig. 91.—CICADA.

To the present order belongs one insect, universally regarded as a very disgusting visitant, the Bed-bug (*Fig. 94*). This creature would appear to be much more common now than in the days of Queen Elizabeth; for, although Shakspeare mentions several insects in his plays, and the word "bug" occurs five or six times, it is never applied to the insect, but is always used as synonymous with bugbear. It is destitute of wings, differing in this respect from some of

those (*Figs. 89, 90*) which feed on the juices of plants, and are sometimes of large size and brilliant colours.



Fig. 92.—BOAT-FLY.

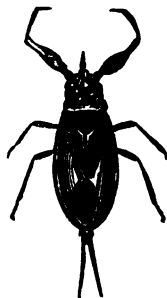


Fig. 93.—NEMA.

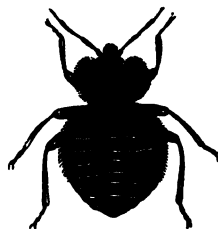


Fig. 94.—BED-BUG (MAGNIFIED).

ORDER VIII.—FLIES, GNATS, ETC.

DIPTERA (TWO-WINGED).

THIS order consists entirely of two-winged flies. The wings are membranous. The mouth is formed for suction; and in certain tribes, such as the Gnat (*Fig. 95*), and the Gad-fly (*Fig. 96*), it is furnished with lancet or razor-shaped organs, to enable it to pierce the skin.

The larvæ of some species live in the most disgusting substances, and speedily effect their removal. Among these are Flesh-flies, whose office it is to consume the dead and decaying bodies of animals, which soon would taint our atmosphere. They are gifted with wonderful powers for,

effecting this object. The young are brought forth alive, and the female will give birth to twenty thousand young. Hence the assertion of Linnæus, with regard to one species,



Fig. 95.—GNAT (MAGNIFIED).



Fig. 96.—TABANUS.

that three of these flies would devour a dead horse as quickly as a lion would do, is perhaps not much overstrained.

These insects must, however, be regarded in another light—as the tormentors of man instead of his benefactors. According to Arthur Young, flies—that is, the common house-flies—constitute “the first of torments in Spain, Italy, and the olive districts of France. Your mouth, eyes, ears, and nose are full of them; they swarm on every eatable; fruit, sugar, milk, everything is attacked by them.” The annoyance occasioned by the Mosquito is noticed by every traveller in the southern parts of Europe and the northern parts of Asia and America. Dr. Clarke states, in his

journey along the frontier of Circassia, that the Cossack soldiers "pass the night upon the bare earth, protected from the Mosquitos by creeping into a kind of sack sufficient only for the covering of a single person." Nor do our domestic animals escape: their sufferings have long since been described by the poet Spencer:—

"As when a swarme of Gnats at eventide
Out of the fennes of Allan doe arise,
Their murmuring, small trumpets sounden wide;
Whiles in the air their clust'ring armies flies,
That as a cloud doth seem to dim the skyes;
Ne man nor beast may rest, or take repast,
For their sharp wounds and noyous injuries;
'Till the fierce northern wind, with blustering blast,
Doth blowe them quite away, and in the ocean cast."

FAERY QUEENE, Book II. c. ix. st. 16.

There are tribes of two-winged insects which delight in the companionship of their fellows during their hours of recreation, and have long been celebrated for their aerial dances. Every one has observed how those belonging to the family of the "Harry Long Legs," and others spoken of as "Midges," appear in multitudes,

—"and weave
Their sports together in the solar beam,
Or in the gloom of twilight hum their joy."

ORDER IX.—CENTIPEDES, SPRING-TAILS, ETC.

APTERA (WITHOUT WINGS).

THE insects, and the tribes allied to insects, which Linnæus included in this division, are now arranged in four orders:—

1. *Centipedes* (Fig. 47) and others possessed of numerous feet, as the *Millipede* (*Julus*, Fig. 97.)



Fig. 97.—JULUS.

II. *Spring-tails*, (Fig. 98). Their forked tail is kept under the body when not in use; when unbent it acts as a spring, and has given origin to the English name.



Fig. 98.—SPRING-TAIL.



Fig. 99.—LOUSE.



Fig. 100.—FLEA.

III. *Lice* (Fig. 99) and other insects, which live as parasites on man and the lower animals; and

IV. *Fleas* (Fig. 100). The mouth is formed for suction, and the hind legs for jumping.

CLASS V.—SPIDERS.

ARACHNIDA.



Fig. 101.—MYGALE.

THE present class includes Spiders, Scorpions, and Mites. They do not, like insects, undergo transformations; and some among them breathe not by tubes, but by lungs. They differ from the true insects also in having eight legs instead of six. The eyes vary in number and position, but are never compound.

All Spiders secrete a poisonous fluid, which is, no doubt, formidable and even fatal to insects, but produces little effect on the human frame. The poison is conveyed through a perforated fang in the mandibles or jaws. In the

Scorpion (*Fig. 102*), on the contrary, it is lodged in the extremity of the slender flexible tail, and the wound is inflicted by the sting by which the tail is terminated.

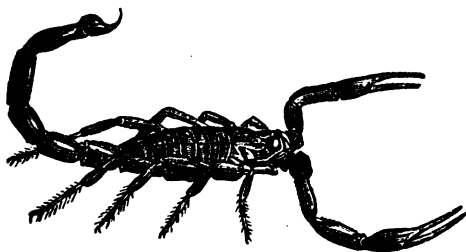


Fig. 102.—SCORPION.

That any creature could be found to fabricate a net, not less ingenious than that of the fisherman, for the capture of its prey; that it should fix it in the right place, and then patiently await the result, is a proceeding so strange, that if we did not see it done daily before our eyes by the common House-spider and Garden-spider, it would seem wonderful. But how much is our wonder increased when we think of the complex fabric of each single thread, for it is made up of more than a thousand threads still more delicate; so that, even when it is so fine as scarcely to be visible to our eyes, it is not a single line, but is in reality a rope composed of more than a thousand strands. This is ascertained by counting the number of little teats at the hinder extremity of the body, whence the threads proceed, and examining the multitude of minute orifices, of which each of them is com-

posed. Add to this, as an example of the wonders which the most common things exhibit when carefully examined, the net of the Garden-spider consists of two distinct kinds of silk. The threads forming the circles are composed of a silk much more elastic than that of the rays; and are studded over with minute globules of a viscid gum, sufficiently adhesive to retain any unwary fly which comes in contact with it. In ordinary circumstances, the threads lose their viscosity by exposure to the air, and require to have it renewed every twenty-four hours. Any observer, by scattering a little fine dust over the web, may satisfy himself that it is retained only on the circles where the minute globules are placed, and not upon the radii, or lines which come from the centre to the circumference. The nets of some spiders are constructed under water—the secretion being insoluble—and are spread out for the capture of aquatic insects.

A great deal of false commiseration has been bestowed upon the flies which fall victims to the voracity of the spider, who has accordingly been regarded as “Cunning and fierce, mixture abhorred.” But, considered aright, there is no cruelty in any animal exercising, for its support, those powers with which it has been endowed by its Creator. It does not kill from wantonness, but from necessity. It must kill, or it must cease to live.

Spiders have been divided into families, which present very considerable differences in their modes of life and in their habitations. The *Mygale* forms a subterranean

neous tube or gallery, lines it with silk, and constructs a door formed of several coats of cemented earth and silk. "This door (*Fig. 103*) the ingenious artist fixes to the entrance of her gallery by a hinge of silk; and, as if acquainted with the laws of gravity, she invariably fixes the hinge at the highest side of the opening, so that the door, when pushed up, shuts again by its own weight." The part against which it closes with great accuracy, and the defences by which it is secured, are not less excellent as mechanical contrivances.



Fig. 103.—NEST OF MYGALE.

The female Spider is remarkable for her parental affection. Professor Hentz thus describes the habits of one species. "When a mother is found with the cocoon containing the progeny, if this be forcibly torn from her, she turns round and grasps it with her mandibles. All her limbs, one by one, may then be torn from her body without forcing her to abandon her hold. But if, without mangling the mother, the cocoon be skilfully removed from her, and suddenly thrown out of sight, she instantaneously loses all her activity, seems paralysed, and coils her tremulous limbs, as if mortally wounded: if the bag be returned, her ferocity and strength are restored the moment she has any perception of its presence, and she rushes to her treasure to defend it to the last."

SOFT-BODIED ANIMALS.

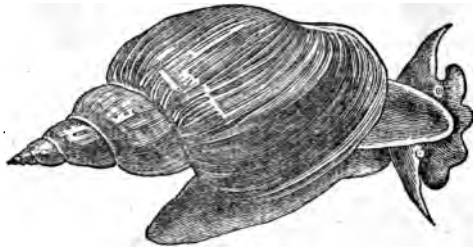
MOLLUSCA.

Fig. 104.—LYMNEUS STAGNALIS.

THE soft-bodied animals, to which the term "*Mollusca*" is applied, constitute another of the primary groups of the animal kingdom. In them we see no longer the jointed structure, which characterised the crustacea and insects. The arrangement of the nerves is also different; and the blood is colourless or not red.

The beautiful variety of form observable in the shells of

different species of Mollusca (*Fig. 105, 106, &c.*), has, in all ages, attracted attention; and the splendour of their colouring is not surpassed by that of our brightest garden-flowers. In some respects it is even superior; for their most



Fig. 105.—BUCCINUM.



Fig. 106.—VOLUTA.

delicate tints become here unfading and permanent, and a peculiar structure of the surface gives rise occasionally to rainbow hues. Among savage tribes, shells are formed into ornaments, and applied to numberless uses.

The difference in point of size is not less remarkable than that of the form and colouring. The *Tridacna*, or Giant Clamp-shell (*Fig. 107*), is said to attain occasionally a weight of more than 500 pounds; from which circumstance the story may have

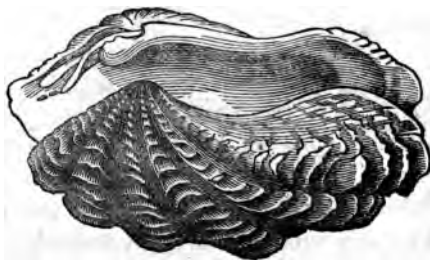


Fig. 107.—TRIDACNA.

originated of an oyster which furnished a dinner to a whole regiment. Let us, in imagination, contrast with this the microscopic shells collected by Soldari in Tuscany, and which were so minute, that numbers of them passed through a paper in which holes had been pricked with a needle of the smallest size.



Fig. 108.—*APORRHAIIS*.
PES PELICANI.

The change of form which shells undergo, as they approach maturity, is sometimes so great, that the full-grown specimen is altogether different from the appearance presented by the same shell in its immature state. Of this the common Leg-of-mutton Shell (*Fig. 108*) of our shores, and the beautiful tribe of *Cypræas* (*Fig. 109*), furnish familiar examples.

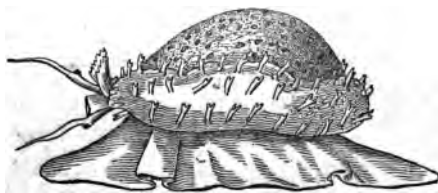


Fig. 109.—*CYPRÆA*.

The **Mollusca** are divided into two great groups: one containing those which, like the common oyster, are destitute of a head; and the other

those which, like the snail, are provided with a head, and generally with mouth, eyes, and tentacula, or feelers. Each of these groups is divided into three Classes, to which our attention may now be directed.

CLASS I.—TUNICATED.

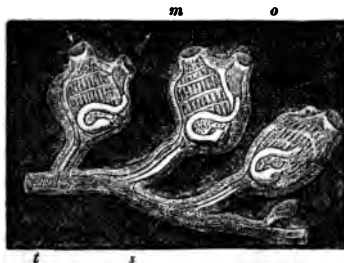
TUNICATA.

Fig. 110.—POROPHORA.*

THERE are some Mollusks which are not naked like the slug, nor provided with a shelly citadel like the oyster, but are furnished with a kind of leathery covering or tunic, and are hence termed "*Tunicated*." The kind best known to our fishermen is a solitary species about the size of the largest common mussel, and to which, from its shape, the name of "paps" is given. The exterior is darkish, warty, and unattractive, and exhibits two orifices, from one of which the animal can squirt water with considerable force. The internal structure is extremely beautiful and delicate. Some of the compound species are branched (*Fig. 110*), and such is their transparency that the movement of the internal organs can be distinctly seen.

* *Fig. 110.*—*m*, Mouth.—*s*, Stomach.—*i*, Intestine.—*o*, Orifice.—*t*, Common Stem. The arrows indicate the direction of the currents of water subservient to respiration.

CLASS II.—ARM-FOOTED.

BRACHIOPODA.



Fig. 111.—TERREBRATULA
PSITTACEA.



Fig. 112.—VALVE OF THE SHELL OF
TERREBRATULA.

THESE are Mollusca, with two shells (*bivalve*), and, like some of those just mentioned, are destitute of the power of locomotion. They are attached to foreign bodies, and are furnished with two long arms (*Fig. 111*), covered with the minute hair-like bodies termed *cilia*, which have been already described (p. 12, 25, 30). They are found abundantly in a fossil state. The species now existing are few in number, and some of them have been brought up from depths of from sixty to ninety fathoms. In the unbroken stillness which must pervade these abysses there can be neither wind nor waves to bring to them the animalcules which they require as food, or to sweep away what would become injurious. Their very existence must therefore depend on their power of producing a perpetual current around them, which they are enabled to effect by the action of the *cilia*, though *organs of such apparent delicacy*.

CLASS III.—OYSTER, SCALLOP, MUSSEL, ETC.

LAMELLIBRANCHIATA.

THE third and last class of those Mollusks which are headless, comprises those which have their gills in the form of membranous plates, a peculiarity indicated in the scientific name by which the order is distinguished. It includes the oyster, the scallop, the cockle, the mussel, and other well-known bivalves, as such shells consisting of two parts are termed.

The mouth of the oyster is situated near the hinge, beneath a kind of hood formed by the edges of the mantle (*Fig. 114*).



Fig. 113.—MACFRA.

But the question naturally arises, how is it supplied with food, the animal itself being utterly incapable of any active exertion for that purpose? This is effected by means of rapid currents which are made to sweep over the entire surface of the gills, and hurry towards the mouth the animalcules and particles of nourishing matter which the water contains. By this beautiful arrangement, respiration and nutrition are provided for at the same time.

Shakspeare has said, "honesty dwells like a miser in a poor-house, as your pearl in your foul oyster;" and the connexion of the oyster with the pearl is one of the interesting

circumstances connected with its history. Moore, with his usual felicity, has referred to the Eastern fable of

——“That rain from the sky
That turns into pearls as it falls in the sea.”

The real facts, as at present known, are scarcely less wonderful. The shell (*Fig. 115*) is pierced by some worm,

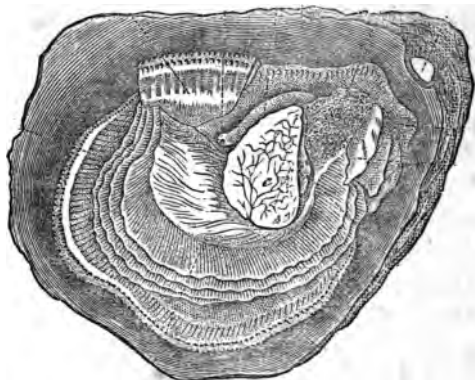


Fig. 114.—ANATOMY OF THE OYSTER.

the oyster deposits the “nacre,” or mother-of-pearl, on the perforated part; or grains of sand or gravel gain admission into the substance of the mantle, and become encrusted by a similar deposit. This would appear to be, in many instances, the origin of the pearls, so highly prized, and still so eagerly sought for. The Romans were extravagantly fond of these ornaments, which they ranked next to the diamond, and are said to have given almost incredible prices for them.

The common Mussel of our coasts lives moored to its "bed" by the silken cable which it constructs for this purpose. The silk which it produces is, however, much surpassed by that of the Pinna, a shell already mentioned (*page 60*).—The silk of the Pinna has been woven into some articles of dress, that in early times were so highly

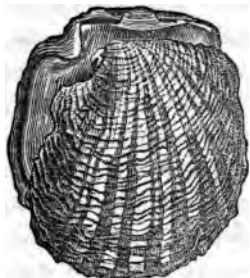


Fig. 115.—PEARL OYSTER.

prized as to be worn only by emperors and kings. At Taranto, in Italy, it is still mixed with about one-third of real silk, and made into gloves, caps, stockings, &c.

Among the Mollusks of the present class, are those which possess the art of boring into hard substances, and living in the excavations thus formed. The one most noted for its ravages is the *Teredo* (*Fig. 116*), which, by its power of perforating wood, does great injury to ships, piers, and all submarine wooden buildings: owing to the general use of metal sheathing, it is now nearly extinct on the British shores.



Fig. 116.—TEREDO.

It is occasionally the pleasing duty of the naturalist to direct attention to some of the many examples, where there springs from "partial evil, universal good;" and perhaps the *Teredo*, notwithstanding the evidence of its destructive powers, might, if the whole truth were known, be ranked among the number of our benefactors. Mr. R. Ball has remarked, "that, but for the maligned *Teredo*, the sea would be so covered with floating logs of timber, as to be to some extent unnavigable; that the rivers of warm latitudes would be choked up by the accumulated driftwood at their mouths, and that their fertile banks would, in many cases, be converted into morasses."

On one occasion, during a stroll along the beach, the waves flung upon the shore a piece of the painted woodwork of some unfortunate vessel. On examining it, I found that it was pierced throughout by the *Teredo*, and that the animals were still living in the galleries they had excavated, and which were lined with shelly matter throughout all their windings. While each animal had used with effect the curious auger-shaped instrument by which the perforations were made, no one had interfered with the progress of his fellows; and almost in every instance, when the borings approached too close, their direction had been changed, and contact or interference thus avoided. That piece of drift timber, the sport of winds and waves, contained within itself a little world of animated existence!

Having now noticed the three classes of the Mollusca which are without a distinct head (*acephalous*), we proceed to those which have a distinct head (*encephalous*); of them there are likewise three classes.

CLASS I.—PTEROPODA.

THE little Mollusks belonging to this order are furnished with two membranous expansions, like fins or wings (*Fig. 117*), and hence the compound term, which signifies “wing-footed,” points out the obvious distinguishing characteristic of the class.

There are several genera; but the species best known (*Clioborealis*) is about an inch in length, and so abundant in the Arctic seas as at times to colour the surface for leagues, and to form an important supply of food to the great whale. The head has six of the wing-like appendages, which appear of a reddish tint from the number of distinct red spots scattered over their surface, and amounting on each to about 300. Every one of these specks, when examined under a microscope, is found to consist of about twenty suckers, each of them mounted on a footstalk, so as to be applied to their prey; so that the total number of suckers on the head of one of these animals is about 360,000, an apparatus for the capture of food without any parallel in the animal creation.

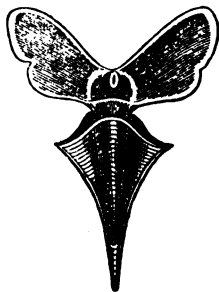


Fig. 117.—HYALEA.

CLASS II.—SLUG, SNAIL, LIMPET.

GASTEROPODA.



Fig. 118.—VOLUTE (THE ANIMAL REPRESENTED IN MOTION).

If we look at the common Snail, as it crawls along, we notice that the only organ it possesses as a substitute for legs is a broad muscular disc, forming the lower surface of the body. Hence the compound term *Gasterópoda* (belly-footed) indicates the peculiarity of its locomotive structure, and is used as the name of the class in which a similar structure prevails (*Fig. 118*).



Fig. 119.—EOLIS.

The class is extremely numerous, and is conveniently distributed into Orders, distinguished by modifications of their respiratory organs. In one order the gills are uncovered (*Fig. 119*) and arranged in various forms, and attached to different parts of the body. The animals are found upon the rocks and sea-weeds on our shore, and floating, with the foot uppermost, on the smooth surface of our bays; they are also dredged up from considerable depths. When placed in sea-water, they

exhibit figures of great delicacy, variety, and elegance, and with a beautiful diversity of colouring. Their size is very different; some of our native species being less than half an inch in length, while others measure so much as four inches.

The common Limpet (*Fig. 120*) forms an example of a Mol-



Fig. 120.—LIMPET.



Fig. 121.—CHITON.

lusk of a different order, in which the gills extend like a fringe round the lower edge of the body, and between the body and the foot. Those who see the Limpet only when left uncovered by the tide, have no idea of the ease with which it can march about when the returning waters once more surround its dwelling. Its little excursions are not, however, merely for amusement; they are undertaken for the important object of procuring food. This consists of sea-weeds of different kinds, which it rasps down with its tongue, a ribbon-shaped instrument longer than its entire body.

The shell of the Limpet consists of one piece; but in the *Chiton* (Fig. 121), an allied genus found near low water-mark, and under stones, the shell is composed of a number of distinct plates. These are so arranged that the edges overlap like the slates of a house, and the ligaments possess such flexibility, that the shell can, at the pleasure of the animal, be rolled into a ball.

That order which is characterised by having the gills concealed under a fold of the mantle, may be illustrated by reference to a creature not uncommon on our shores, the *Aplysia* or Sea-hare (Fig. 122.) Its common English name has

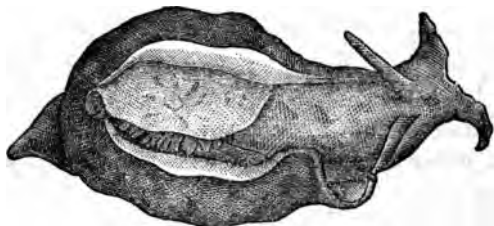


Fig. 122.—APLYSIA.

probably been suggested by the form of the upper pair of tentacula, which present some resemblance to the ears of a hare. This creature, it was once believed, held such antipathy to man, that its touch would cause the hair to fall off; and it also was said to supply a poison, the operation of which was speedy and inevitable.

Of the tribes which breathe by lungs, the common Slugs and snails offer familiar examples. Even of these species

which are aquatic, many come to the surface for respiration, and float or move with the back downwards. The *Planorbis* (Fig. 123) and the *Lymnæus* (Fig. 104) may be thus seen on a summer's day traversing the surface of ponds and ditches, in an easy undulating line, or suspended there in luxurious repose, perhaps

“To taste the freshness of heaven’s breath, and feel
That light is pleasant, and the sunbeam warm.”

We might naturally suppose that the soft skin of those species which are unprotected with shells, was possessed of great sensibility, but such does not appear to be the case. Baron Ferussac states, that he has seen slugs allow their skins to

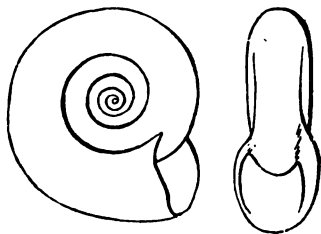


Fig. 123.—PLANORBIS.

be eaten by others, and, in spite of large wounds thus produced, show no sign of pain. They possess, in a high degree, the power of repairing injuries, and of reproducing lost parts.

Of Snails, the number of species is very considerable. Among those which are natives of these countries, are some which afford a plentiful supply of food to two of our favourite songsters, the blackbird and the thrush. Those with thin shells are, of course, the most in request, and are brought to some flat stone, and there broken to pieces. There are others which abound upon sandy slopes and hillocks; and it

is a common belief that these little snails are eaten, in vast numbers, by the sheep which graze upon the scanty pasturage of the sandy knolls, and that they form a very fattening kind of food.

The *Helices* or Snails are not, however, used only as food for birds, or for sheep, and for other quadrupeds, such as the hedgehog. There is a species, found in the southern and midland counties of England, which has been considered a delicacy by man himself. From the time of the Romans, who fattened them as an article of food, they have been eaten by several European nations, dressed in various ways. Lister tells us the manner in which they were cooked in England in his time [1678]. "They are boiled in spring-water, and when seasoned with oil, salt, and pepper, make a dainty dish."

Fig. 124 represents a species belonging to a different order. Such shells occur in groups, and are always found



Fig. 124.—VERMETUS.

attached to other bodies. They bear some resemblance to the tubes of the *Serpulæ* (*Fig. 29*), though the contained animals are widely different.

The Dog-whelk, a shell that is common on our shores, furnishes a purplish dye, which makes an indelible marking-ink. It is not, however, to be supposed that this fluid is

identical with that dye for which Tyre was so celebrated when its "merchants were princes, and its traffickers the honourable of the earth;" and which was reserved for the brilliant hangings of temples, or the costly robes of priests and kings. By what shell this dye was produced, and how it was extracted, have been questions respecting which much difference of opinion has prevailed.

Mr. Wilde, when visiting the ruins of Tyre in 1838, found on the shore a number of round holes cut in the solid sand-stone rock; within them, and on the adjacent beach, were masses consisting of large quantities of broken shells. He inferred that the shells had been placed in those holes or mortars to be pounded in the manner mentioned by Pliny, for the purpose of extracting the fluid which the animal contained. This opinion received confirmation, from his finding that the broken shells belonged to a species of *Murex*,



Fig. 125.—MUREX.

one of those from which the Tyrian dye is known to have been obtained; and also from the same species being still found, in a living state, on the adjoining beach. The genus contains shells of great beauty (*Fig. 125*), some of which are furnished with long and delicate spines.

CLASS III.—CUTTLE FISHES.

CEPHALOPODA.

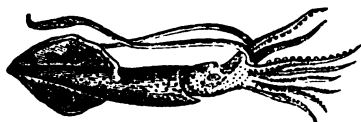


Fig. 126.—CALAMARY.

If we look at a Cuttle-fish (*Fig. 126*), we notice that the head is surrounded by a number of appendages; this peculiarity is implied

in the scientific term by which the class is named.

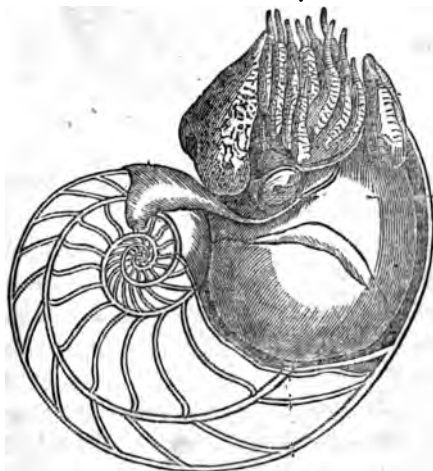


Fig. 127.—PEARLY NAUTILUS, WITH SHELL LAID OPEN.

In many important points of structure, this class is superior to any of the preceding ones; and here we notice the existence of a true internal skeleton, of a peculiar kind, the first approach to the most obvious characteristic of the higher tribes of animals.

Though the shell of the Pearly Nautilus (*Fig. 127*) is common in museums, the capture of the living animal is of rare occurrence. We know, however, that

it occupies only the outer chamber of its shell, and that it can rise to the surface or descend at pleasure. Similar in structure and in powers were the Ammonites (*Figs. 128, 129*),



Fig. 128.

AMMONITES.

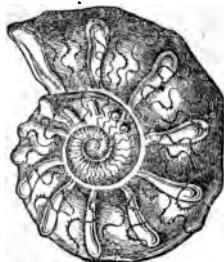


Fig. 129.

which, at former periods of the earth's history, must have been living in its seas, though now known only as fossil.

Other Cuttle-fishes abound in all seas, and are arranged in two divisions, according as they have eight or ten arms. To the latter group belongs the *Loligo* or Calamary (*Fig. 126*)—the common *Sepia* or Cuttle-fish—and the *Loligopsis* (*Fig. 130*), so remarkable for the great length of one pair of its arms. All possess a shell or internal skeleton, differing in form and structure in different species; all are furnished with a powerful horny beak for tearing up their prey, and with an ink-bag, from which, at pleasure, they can emit a fluid which darkens the water and favours their escape from their enemies.

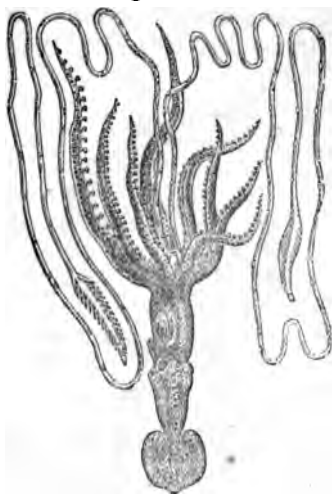


Fig. 130.—LOLIGOPSIS.

Of the eight-armed division, the most interesting species is the Argonaut or Paper Nautilus, regarded as giving to man the first example of the art of navigation. It has been usually represented, as in the annexed figure (*Fig. 131*), with six arms extended over the sides of its little vessel to act as oars, and two others up-raised as sails. Such being the universal belief, poets have not failed to celebrate its nautical powers. Thus, Montgomery has given us a picture so exquisitely finished, that even the naturalist can scarcely

bring himself to wish that it were different:—

“Light as a flake of foam upon the wind,
Keel upward from the deep emerged a shell,
Shaped like the moon ere half her horn is fill’d;
Fraught with young life, it righted as it rose,
And moved at will along the yielding water.
The native pilot of this little bark
Put out a tier of oars on either side,
Spread to the wafting breeze a twofold sail,
And mounted up and glided down the billow
In happy freedom, pleased to feel the air,
And wander in the luxury of light.”—PELICAN ISLAND.

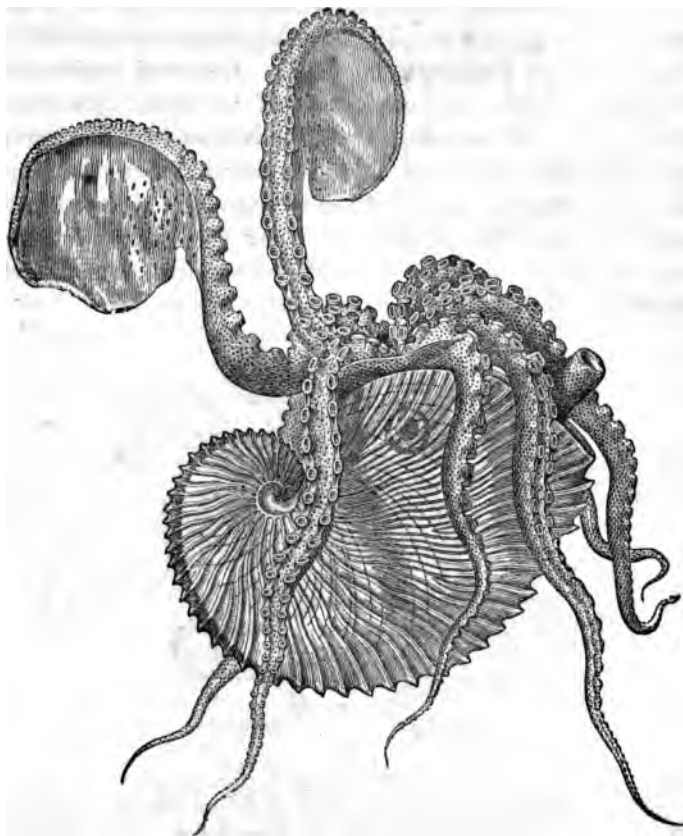


Fig. 131.—ARGONAUT, OR PAPER NAUTILUS.

It is now ascertained that the Nautilus never moves in the manner here described. The account, though so universally accredited, is altogether fabulous. It moves backwards through the water by the action of its arms, like other Cuttle-fishes. It can creep along the bottom, and, like many other Mollusks, it can rise to the surface; but there the arms are never employed as oars; and those which have the broad expanded membranous disc are never used as sails. The true use of this disc seems to be, to secrete the shelly matter needful for the repair or enlargement of the shell.

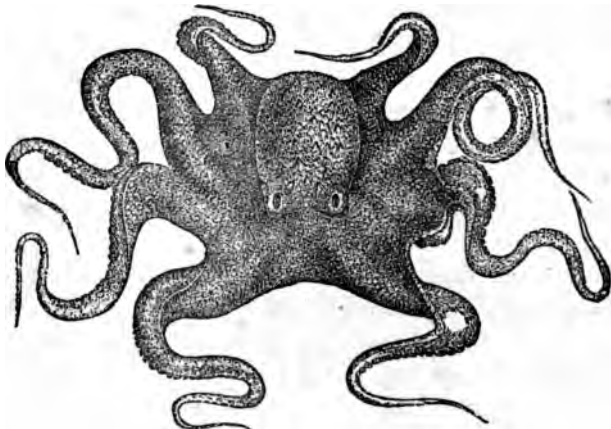


Fig. 132.—OCTOPUS OR POULPE.

The *Octopus*, or common *Poulpe* (Fig. 132), is a species of eight-armed Cuttle-fish, whose strange figure and staring eyes cannot fail to excite attention, especially when its

twisting arms are employed in the act of walking. These arms, have, however, another office, which is thus described by Professor Jones. "They are used, if required, as agents in seizing prey, and of so terrible a character, that, armed with these formidable organs, the Poulpe becomes one of the most destructive inhabitants of the sea; for neither superior strength nor activity, nor even defensive armour, is sufficient to save its victims from the ruthless ferocity of such a foe. A hundred and twenty pairs of suckers, more perfect and efficacious than the cupping-glasses of human contrivance, crowd the lower surface of every one of the eight flexible arms. If the Poulpe but touch its prey, it is enough; once a few of these tenacious suckers get firm hold, the swiftness of the fish is unavailing, as it is soon trammelled on all sides by the firmly-holding tentacula, and dragged to the mouth of its destroyer. The shell of the lobster or crab is a vain protection, for the hard and crooked beak of the Cuttle-fish easily breaks to pieces the frail armour."

An instance of its powers, both of attack and escape, fell under the observation of Mr. Broderip, of London. He attempted, "with a hand-net, to catch an Octopus that was floating within sight, with its long and flexible arms entwined round a fish, which it was tearing to pieces with its sharp hawk's-bill. The Cuttle-fish allowed the net to approach within a short distance of it before it relinquished its prey, when, in an instant, it relaxed its thousand suckers, exploded its inky ammunition, and rapidly retreated, under cover of the cloud

which it had occasioned, by rapid and vigorous strokes of its circular web."

Besides the capability of thus escaping when pursued, it also possesses, in common with others of its class, a protection against being discovered, which, conjoined with the other, surpasses the cloak of darkness in the fairy tale. It can change its colour to that of the adjacent objects; so that, like the Ptarmigan in the snow, it becomes comparatively inconspicuous. In fact, the power which Cuttle-fishes possess, of changing their colour, and making it harmonize with that of the surface on which they rest, appears quite as remarkable as that which has long been celebrated in the Chameleon.

The flesh of the Cuttle-fish, especially that of the arms, is considered highly nutritious, and though not used in these countries, is much sought for in other parts of the world, and occasionally exposed for sale in the market at Naples and elsewhere. Our most common species forms the bait with which one half of the cod taken at Newfoundland is caught. During violent gales of wind, hundreds of tons of them are thrown up there on the beach. Other species appear elsewhere to be no less numerous, forming on the surface of the water a dense shoal, sometimes extending several hundred yards in extent.

Stories are told of gigantic Cuttle-fish throwing their arms over luckless vessels, the thickness of each arm being equal to that of the mizen-mast. But it is the business of science

to dispel these exaggerations, and patiently and laboriously to seek out the truth, hailing with joy each new light which may shine on the subject of inquiry. In the College of Surgeons, London, are preserved portions of the largest specimen of a Cuttle-fish which any of our museums contain. The carcass was found during Captain Cook's first voyage, floating on the sea surrounded by aquatic birds, who were feeding on its remains. Comparing the size of this animal, from the parts existing, with that of the smaller perfect animals, its body must have been at least four feet long, which added to the tentacula, would make it seven feet in length. We have, in these countries, no positive evidence of the existence of any Cuttle-fish of larger dimensions, but the general prevalence of such belief, inclines naturalists at present not to deny the possibility of their occurrence.

The remains of animals of this family have been found along with the undigested portions of the food of the gigantic reptiles of remote ages; and thus, in the words of Dr. Buckland, "the general law of nature, which bids to eat and be eaten in their turn, is shown to have been co-extensive with animal existence on our globe; the *carnivora* (flesh-eaters) in each period of the world's history fulfilling their destined office, to check excess in the progress of life, and maintain the balance of creation."

We have now finished our brief survey of the Invertebrate Animals, commencing with beings so minute as to be known to us only by means of the microscope, and ending with those

which possess a highly complex structure and an internal skeleton of a peculiar kind. We have seen in our progress, many strange forms and modes of life—creatures widely different from each other, yet each “perfect after its kind;” and we have thus been prepared to enter, with greater advantage, on the study of the higher orders of animals,—those to which the Second Part of this little book is devoted.

END OF PART I.

VERTEBRATE ANIMALS.

WE are now prepared to enter upon the examination of the more highly organised beings which constitute the fourth great division of the animal kingdom. These have a more complex structure and a higher intelligence; some among them are distinguished by their great size and strength; and in this class, after passing many inferior grades, we reach to man himself.

The most obvious character by which the Vertebrate Animals are distinguished from the lower tribes, is the possession of a skull and back-bone. They have red blood, a muscular heart, distinct senses, a mouth furnished with two jaws moving vertically, and limbs which never exceed four in number. They are distributed into four classes.

I. FISHES.

II. REPTILES (*Tortoises, Lizards, Serpents, and Frogs*).

III. BIRDS.

IV. MAMMALIA (*Man, Bats, Whales, and Quadrupeds*).

Two of these, Fishes and Reptiles, are, with few exceptions, cold-blooded; and the remaining two, Birds and Mammalia, are warm-blooded.

CLASS I.—FISHES.

PISCES.

“They that go down to the sea in ships, and occupy their business in great waters;

“These men see the works of the Lord, and his wonders in the deep.”

PSALMS.

FISHES, according to the definition of the Naturalist, are cold-blooded animals, eminently and specially adapted for living as inhabitants of the water. The body is, in most instances, covered with scales; they gave fins instead of feet; and respiration is carried on by gills. The young are produced from eggs.

Fishes are widely distributed throughout lakes, rivers, and seas, and live at very different temperatures. Even the same species seems capable of bearing considerable extremes of heat and cold. The delicate-looking Goldfish thrives and breeds to excess in water the temperature of which is so high as 80°, and has been frozen into a solid body of ice, and revived by the gradual application of warmth.

The great variety of form observable among fishes may be illustrated by reference to some of our most common native species—the Eel, the Plaice, and the Haddock. Some can, to a certain extent, vary the form of their body at pleasure,

Thus the *Diodon*, or Globe-fish (*Fig. 133*), by swallowing air, can inflate itself like a balloon. The air passes into the first stomach, which occupies the lower surface of the body. This part, becoming the lightest, is that which remains uppermost, and the fish floats on the surface with its usual position reversed, and all its spines erect, presenting on every side a bristling front to all assailants.

Many species are furnished with a beautiful apparatus, by means of which they can alter what is termed the "specific

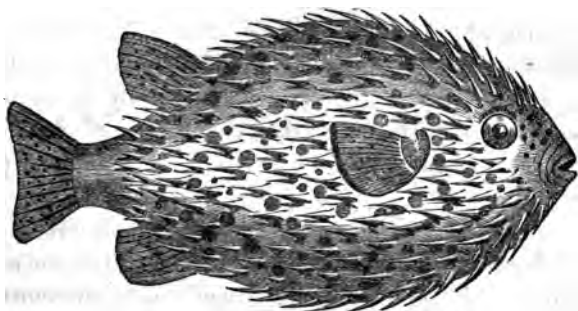


Fig. 133.—GLOBE-FISH.

gravity" of their bodies; in other words, they can make their bodies lighter or heavier than an equal bulk of water, and can thus rise or sink without effort. This is effected by means of a membranous bag, known as the "swim-bladder;" the same part which in the Cod-fish is termed the "sound."

The external organs of motion consist of the tail and fins, and the fins are named from the part of the body to which

they are attached. Those on the back are the "dorsal," on what may be called the shoulders of the fish the "pectoral," and these nearest to them, but on the lower surface of the body, the "ventral." These terms are derived from the Latin words expressive of these several parts.

In the Flying Fish (*Fig. 134*), the pectoral fins are ex-



Fig. 134.—FLYING FISH. ;

tremely large, and remind us of wings. But in reality the fins never act as wings; nor can these fish, with correctness, be said to *fly*. They have the power of springing out of the water with such force, that Capt. Hall has seen them pass over a space of 200 yards; but they cannot alter the direction of their course, and the expanded fins, when in the air, serve only to make the descent more gradual.

There is great diversity in the food of fishes. Some live on marine vegetables, others upon animals belonging to the invertebrate tribes, and upon the young and weaker individuals of their own class.

The young are in general produced from eggs deposited by the female and fertilized by the male. The lobes containing the eggs or ova are those to which we are accustomed to give the name of "pea" or "roe," and the corresponding but softer lobes in the male fish are those which are equally well known as the "milt." The number of ova, in some of our native fishes, is so very astonishing that it would be regarded with doubt, except on the most unimpeachable testimony. So many as 280,000 have been taken from a Perch of only half a pound weight; and the Cod-fish is said to contain several millions. Few of the young ever live to attain maturity; they form the appointed food of their more powerful neighbours. We see, therefore, in the profusion in which they are produced, a wise provision for the continual waste; or more properly, the never-ending consumption.

Various are the weapons, offensive and defensive, with which fishes are furnished.

The common Stickle-back (*Fig. 135*) of our streams, at the lower surface of its body has a stiff, sharp spine, which can be erected at pleasure so firmly, that the fish may be said, in military phrase, "to fix bayonets." The Stickle-back is an irritable and pugnacious little fellow, and with this bayonet of his

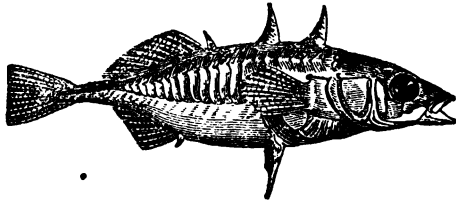


Fig. 135.—STICKLE-BACK.

has been seen to rip up the belly of an opponent, so that he sank to the bottom and died of his wound.

The annexed figure of the Saw-fish (*Fig. 136*), represents its peculiar weapon; that of the Sword-fish (*Fig. 137*) is still more formidable. The upper jaw forms the sword, which is frequently three or four feet long. The fish occasionally attains a length of more than twelve feet, and a weight of more than four hundred pounds. It is a commonly received opinion, that the Sword-fish has a great hostility to the whale, and that whenever it drives its sword-like beak into the hull of a ship at sea, the vessel has been mistaken for that animal.

The force with which this is done must be very considerable, for not only is the copper sheathing of the vessel occasionally pierced, but even several inches of the solid timber.



Fig. 136.—SAW-FISH. Instances are even recorded of vessels having suddenly sprung a leak, and being with difficulty got into port, from injury thus occasioned by the **Sword-fish.**



Fig. 137.—SWORD-FISH.

A still more remarkable mode of defence is, that of giving a severe electric shock. The Torpedo, or Electric Ray of our own shores (*Fig. 138*), is one example of this; and another is furnished by the Electric Eel of the South American rivers, whose shock is sufficiently powerful to stun and even destroy horses.

The skeleton of some fishes is composed of cartilage or gristle, that of others is of bone. Fishes are, therefore, arranged in two great divisions, according to the nature of the skeleton. Those which have the skeleton of bone form much the more numerous group: this is divided into two other groups, in one of which the fins upon the back are composed wholly or in part of stiff rays united by a membrane; and in the other the fins have soft flexible rays, dividing into numerous branches. The groups thus formed are again subdivided, according to the presence or absence of certain fins—the difference in their relative positions—the variety in the structure of the gills and gill-covers, and other details of secondary importance. In this way, according to Cuvier's classification, all fishes are arranged in nine Orders, three of them being devoted to the "cartilaginous," or those which have the skeleton of cartilage or gristle, and six to the "osseous," or those in which the skeleton is formed of bone.



Fig. 138.—TORPEDO.

CARTILAGINOUS FISHES.

ORDER I.—LAMPREYS.

THE first order of these fishes has its peculiarities well exhibited in the River Lamprey (*Fig. 139*). A row of circular

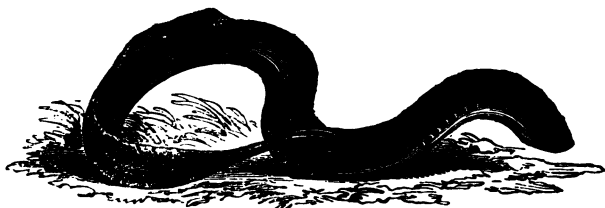


Fig. 139.—RIVER LAMPREY.

openings along each side of the neck, leads to gills of a corresponding form; and the circular mouth by means of which the fish can adhere to stones, has procured for the family a scientific name which signifies “stone-suckers.”

ORDER II.—SHARKS AND RAYS.

THESE fishes, though differing much in external form, belong to the same group—one which is distinguished by the structure of the gills, the long-shaped gill-apertures on the neck, and the peculiar form of the mouth.

The figure (*Fig. 140*) represents the small-spotted Dog-fish, one of the family of the Sharks, and an object of great



Fig. 140.—SMALL-SPOTTED DOG-FISH.

dislike to fishermen, because of the injury which they believe it causes to their fishing.

The eggs of both Sharks and Rays are few in number, and are not deposited on the sand or gravel, but each egg is enclosed, for greater safety, in a horny case, attached by long tendrils to the larger sea-weeds; and among the Sharks of the largest size, some bring forth their young alive. The empty egg-cases are frequently found on the sea-shore, and

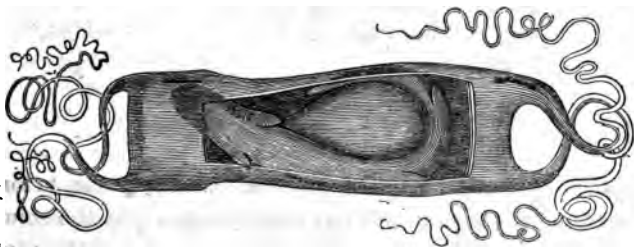


Fig. 141.—EGG-BAG, WITH YOUNG SHARK.

are well known by the name of “sea-purses,” “mermaids’

purses," and other local terms. The longer and narrower-shaped belong to the Sharks and Dog-fishes; the broader and shorter ones to the Skates or Rays. The figure (*Fig. 141*) represents the case laid open, and the young Dog-fish, attached to the "yoke," or membranous bag of nutriment. Water is admitted by means of a slit at each end of the purse.

The Sharks are very tenacious of life, and some of them attain a great size. The Basking Shark, a species found off these coasts, has been known to measure thirty-six feet in length, and is one of the largest of the true fishes.

ORDER III.—STURGEONS.

In the third order of Cartilaginous fishes, there is an approach, in some points to those belonging to the other great group. The gills are comb-shaped, and there is

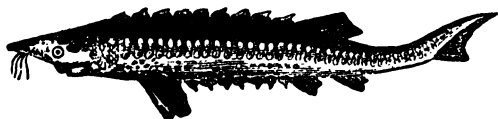


Fig. 142.—STURGEON.

one large gill-aperture. This group is represented by the Sturgeon (*Fig.*

142), a fish which attains so large a size, that one taken in the Esk weighed 464 lbs. The form of the tail in the Dog-fish (*Fig. 140*) and the Sturgeon (*Fig. 142*) is very unlike that of the Pollan (*Fig. 149*) or the Pilot-fish (*Fig. 152*), and forms one of the most obvious external characters by which the Cartilaginous fishes may be distinguished from the Osseous.

OSSEOUS FISHES.

WITH THE RAYS OF THE FINS FLEXIBLE.

“Our plenteous streams a various race supply,
 The bright-eyed Perch, with fins of Tyrian dye,
 The Silver Eel, in shining volumes roll'd,
 The Yellow Carp, in scales bedrop'd with gold,
 Swift Trouts, diversified with crimson stains,
 And Pikes, the tyrants of the watery plains.”—POPE.

ORDER I.—GLOBE-FISHES.

THE first order of fishes, with the skeleton of bone, has structural peculiarities which connect it with both the Osseous and the Cartilaginous tribes. To it belongs the Globe-fish already mentioned (page 131, *Fig.* 133).

ORDER II.—PIPE-FISHES.

THE second order is one in which the gills are arranged like little tufts, as in the Pipe-fishes, which are found abundantly on certain parts of the coast. Their skin is not covered with scales, but formed of plates nicely joined together, like that kind of pavement called “tesselated.” The one represented

in the annexed figure (*Fig. 143*) is the largest of our native species, and is furnished with a curious receptacle, in which the young are for a time carried about. It resembles, in



Fig. 143.—PIPE-FISH.

some respects, the well-known pouch of the female Kangaroo; but, strange to say, among the Pipe-fishes, the marsupial pouch belongs not to the female but to the *male*. In the month of July, the young are hatched and quit the pouch, but they follow their father, and return for shelter into their nursery when danger threatens.

ORDER III.—EELS.

THE fishes of the next order are distinguished by the total absence of the ventral fins, and bear a scientific name which has reference to this peculiarity. The species common on our shores exhibit a great contrast to each other in point of size. The little Sand-eel is usually from five to seven inches

in length; while the Conger Eel (*Fig. 144*) is sometimes more than ten feet long, and 100, or even 130 lbs. in weight.

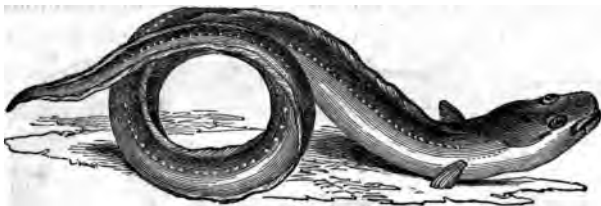


Fig. 144.—CONGER EEL.

There is a notion yet current that common Eels going into the sea remain there, and grow into Congers; an idea as unfounded as that of the child, who supposes that ducks will grow into geese.

ORDER IV.—TURBOT, COD, &c.

THE annexed figure represents the Remora (*Fig. 145*), a fish remarkable for an adhesive or sucking disc, which covers the upper part of the head, and enables it to adhere to the body of another fish, or to the bottom of a ves-

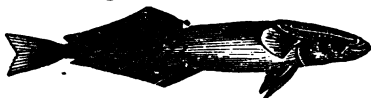


Fig. 145.—REMORA.

sel. The species is interesting from this peculiarity, the more so because, according to old fables, it was said to have the power of stopping a vessel, even in her most rapid course.

The sucking disc of the Lump-sucker, instead of being on the head, is at the lower surface of the body, and is formed in fact by the ventral fins, which, joining together, make a concave disc, by means of which it can adhere to stones or other bodies. The Lump-sucker (*Fig. 146*) arrests our atten-

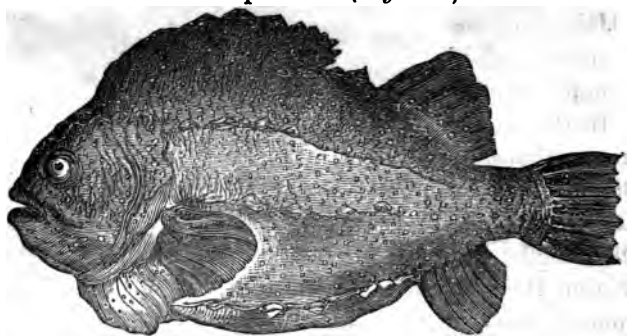


Fig. 146.—LUMP-SUCKER.

tion by his uncouth shape, red eyes, and the bright tints of blue, purple, and orange which are seen upon his body.

Among the fishes belonging to the present order, are some

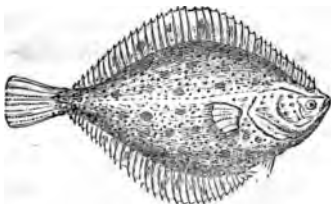


Fig. 147.—PLAICE.

which are well known and highly prized for the supply of food which they afford to man. Such as the Plaice (*Fig. 147*), the Turbot, and other well known Flat-fish. Few

are aware of their importance regarded merely in the light of a marketable commodity.

It is stated that for the Turbot brought to the London market, the Dutch are paid so large a sum as £80,000 a year.

To another family belong the Cod (*Fig. 148*), the Haddock, the Whiting, the Hake, the Ling, and others, which give employment on the British coasts, to many thousands



Fig. 148.—Cod.

of hardy boatmen and sailors. The great importance and value of the Newfoundland Cod Fishery is well known. Man annually derives from it an immense supply of food; and even the oil procured from the liver of the fish, is of commercial and medicinal importance.

Let the reader contrast the position of the *ventral* fins in the Lump-sucker (*Fig. 146*), or the Cod (*Fig. 148*), with that of the same fins in the Pollan (*Fig. 149*), and he will perceive that in the two former they are placed under the *pectoral* fins, while in the latter, they are at a distance from the head, beneath the *abdomen* or belly. This difference constitutes the distinction between the fishes of this order and of the next.

ORDER V.—HERRING, SALMON, &c.

“Forthwith the sounds and seas, each creek and bay,
 With fry innumerable swarm, and shoals
 Of fish that with their fins, and shining scales,
 Glide under the green wave, in sculls that oft
 Bank the mid sea.”—MILTON.

THE description here given by the poet, is, to some extent, realized by the multitudes in which the Pilchard—a fish belonging to the same family as the Herring—sometimes appears.

Ranking still higher as an object of national importance is the Herring itself, which gives occupation to thousands around the British coasts, and supplies to hundreds of thousands a cheap and favourite article of diet.

By Pennant, the approach of the Herring has been described as that of a mighty army, which, coming from the arctic circle, divides at the Shetland Isles into two great bodies, one of which fills the creeks and bays of the east coast of Britain, while the other, passing along the west, separates towards the north of Ireland into two great divisions—“one of which takes to the western side, and is scarcely perceived, being soon lost in the immensity of the Atlantic; but the other, which passes into the Irish Sea, rejoices and feeds the inhabitants of the coasts that border on it.”

This account, though circumstantial, is altogether incorrect. The Herring does not abound in the arctic seas; and

the division of the mighty army into brigades, which pursue their way along the eastern and western shores, is purely imaginary. The Herring does perform a migration, but of a limited range. It comes to the shores for the purpose of spawning, and this being accomplished it returns to the deeper water, where it habitually dwells. It is not a visitant from a distant region, but is like the Pilchard, a constant dweller in our own seas.

The Pollan (*Fig. 149*) is a fish which is not unfrequently

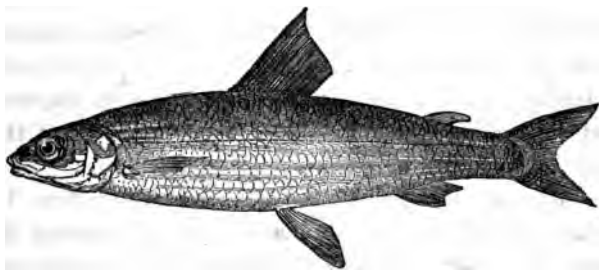


Fig. 149.—POLLAN.

called the “fresh-water Herring.” It is an Irish species, found in Lough Derg, Lough Erne, and Lough Neagh; and approaches the coasts in large shoals, not only during spring and summer, but when the autumn is far advanced. They are brought in quantities to Belfast, and when the supply is good, the cry of “fresh Pollan” prevails even to a greater extent than that of “fresh Herring,” though both fishes are in season at the same period of the year.

Passing by the different species of lake and river Trout, we come to the most important member of the present family, the Salmon.

During the floods of winter and early spring, this fish descends the river to the sea, lean and ill-conditioned, and returns in a few months, plump, well-conditioned, and greatly increased in size, from the abundance of food derived from small crustacea, fishes, and other marine animals and their ova. It is on their return from the sea, for the purpose of spawning, that the Salmon are taken. This occurs during the summer and autumn months, the precise time being different in different rivers.

Impelled onwards by the instinct which prompts this migration, the Salmon endeavours to surmount all obstacles that lie in its course, and flings itself over ledges of rock ten feet or more in height above the surface of the water. It is said that at the falls of Kilmorac, in Inverness-shire, the Frasers of Lovat, lords of the manor, used occasionally, in a very singular manner, to bring this power under the notice of their guests. On a flat rock at the south side of the fall, and close to the edge of the water, a kettle was kept boiling, and the company waited until a Salmon fell into the kettle and was cooked in their presence.

Another family is that of the Pike, a strong, fierce, active, and voracious fish, of whose audacity many stories are told. Gesner relates that a Pike in the Rhone seized on the lips of a mule that was brought to water, and that the beast drew

the fish out before it could disengage itself. "At Lord Gower's canal at Trentham, a Pike seized the head of a swan as she was feeding under water, and gorged so much of it as killed them both; the servants, perceiving the swan with its head under water for a longer time than usual, took the boat, and found both swan and Pike dead."

ORDER VI.—SPINY-FINNED FISHES.

THE remaining fishes have the dorsal or back fins supported in part by rays, which are spinous and undivided. In all of them the gills are arches, presenting the comb-like structure so well known in our most common and valuable fishes.

Of the habits of the Riband-shaped fishes, which form a group in the present order, little is known; but one fact may be mentioned to show how appropriate is their name. A specimen of the Red Bandfish (*Fig. 150*) in 1837, when the

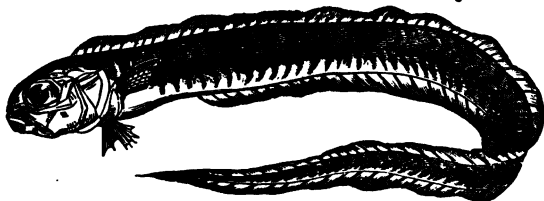


Fig. 150.—RED BANDFISH.

penny postage was unknown, was sent to Mr. W. Thompson of Belfast, through the post-office, although nineteen

and a half inches long; it was folded up like a riband, and passed in a franked letter of the ordinary size and legal weight—under an ounce.

The next family contains the Sword-fish (*Fig. 137*), and others which, either from their habits or traditions with which they are associated, are regarded with more than usual interest. One of them is the John Dory (*Fig. 151*)

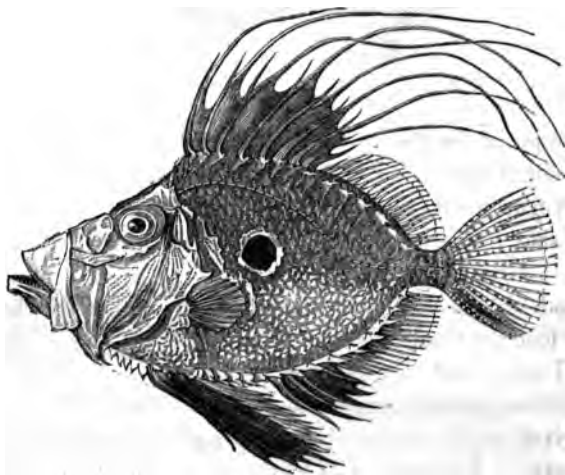


Fig. 151.—JOHN DORY.

which contends with the Haddock for the honour of bearing the marks of St. Peter's fingers—each being supposed to have been the fish out of whose mouth the Apostle took the tribute money, leaving on its sides, in proof of the identity,

SPINY-FINNED FISHES.

the marks of his finger and thumb. Another is the Pilot-fish (*Fig. 152*), celebrated for its attendance on the large Sharks,

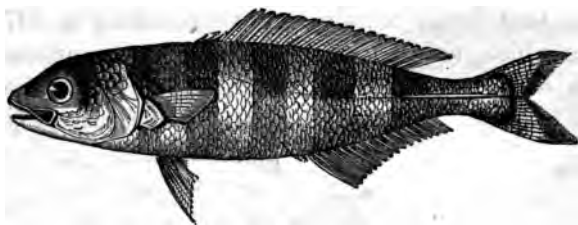


Fig. 152.—PILOT-FISH.

and supposed by the ancients to have pointed out to navigators their desired course, and borne them company during their voyage. A third is the Tunny (*Fig. 153*), a fish of large size, though here represented by a very diminutive figure. One killed at Inverary weighed 460lbs. and measured seven feet ten inches in length. The Tunny visits the shores of the Mediterranean in great shoals, and gives origin to an extensive and valuable branch of commerce. It is spoken of by the fishermen there as warm-blooded, and observations show that in this they are quite correct. It swims near the surface of the water, in this respect resembling the Bonito, a fish with blood as warm as that of a man! The Bonito is frequently mentioned by navigators as one of the most ruthless pursuers of the Flying-fish.

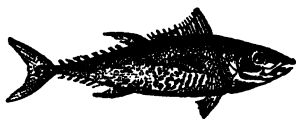


Fig. 153.—TUNNY.

In our progress through the different grades of animals, we occasionally meet with individuals which seem to combine the characteristics of two distinct groups, and render it

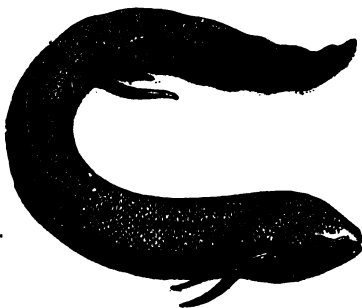


Fig. 154.—LEPIDOSIREN.

an interesting problem to determine, in which they should be placed. Such is the Lepidosiren (*Fig. 154*), an animal which inhabits a part of the river Gambia, which overflows extensive tracts. Such individuals as do not follow the retreating waters, escape from the

scorching rays of the African sun by burrowing in the mud, which is soon baked hard above them. There they remain, in a torpid state, until the return of the rainy season again awakes them to activity.

This singular creature combines, to such an extent, the characters of a fish and of a reptile, that naturalists are not yet agreed as to which class it should belong. Professor Owen is of opinion it should rank among fishes. To us, in our onward course through the various groups of the animal kingdom, it presents itself as a connecting link between the two classes, and serves naturally to lead us from the Fishes to the Reptiles.

CLASS II.—REPTILES.

REPTILIA.

REPTILES constitute another of the great divisions of vertebrated animals. Some of them breathe by lungs only; others by gills and lungs. The blood is cold. The young are produced from eggs. They are arranged in four orders—Frogs, Serpents, Lizards, and Tortoises.

ORDER I.—TOADS, FROGS, &c.

AMPHIBIA.

THESE Reptiles may be separated into two divisions—those which possess both lungs and gills throughout the entire period of life, and those which have gills in their young state, and acquire lungs as they approach maturity. The former group contains some animals of very singular structure and habits; as the Axolotl (*Fig. 155*), the flesh of which is regarded as an article of luxury by the inhabitants of the city of Mexico, near to which it is taken.

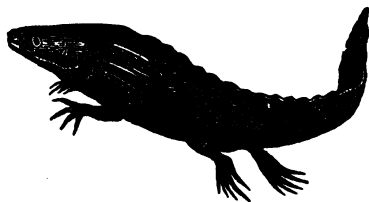


Fig. 155.—AXOLOTL.

The latter group has, however, especial claims on our attention; for in the Frogs, Toads, and Newts of these countries, we have the opportunity of watching the successive steps by which they become fitted for breathing air, instead of continuing to use an apparatus adapted, like that of fishes, for respiration in water only.

The eggs of the common Frog are deposited at the bottom of a pool of water, each egg consisting of a black centre, surrounded by a covering of glutinous matter.

When the little Tadpole has burst from its prison, the leaf-shaped gills begin to appear, and increase rapidly in size until they attain their greatest development. They are now objects of singular beauty under the microscope; for such is their transparency that the course of every globule of blood, as it passes up or down the main stem, or enters the inlets presented by each leaf, is distinctly visible. This period of expansion is, however, more temporary than that of many of our cherished garden flowers. The tufted gills shrink in size until they are concealed, like the gills of fishes. The little Tadpole (*Fig. 156*), begins to feed on



Fig. 156.



Fig. 157.

decaying vegetable matter; the tail becomes a large and powerful organ for locomotion, and a rapid increase in the size of the body is perceptible. After a time the hinder-foot

become developed (*Fig. 157*); then the fore-feet (*Fig. 159*); the tail shrinks; the form of the perfect animal is assumed (*Fig. 158*); the remaining vestige of the tail disappears (*Fig. 160*); and instead of an aquatic animal, breathing by



Fig. 158.



Fig. 159.



Fig. 160.

gills, and subsisting on vegetables, we have one fitted for dwelling upon land, breathing by lungs, and feeding upon smaller animals, such as slugs and insects.

In some of the countries of both temperate and tropical regions there are Frogs which from their habitation are called Tree-frogs (*Fig. 161*). They are described as beautiful and active little animals, not unlike in their colours to those of the trunks and foliage, and furnished at the end of their toes with small cushions or pads, by means of which they can adhere to smooth surfaces.



Fig. 161.—TREE-FROG.

The Frog is believed to have been introduced into Ireland in the early part of the last century. The common Toad is there unknown, its absence, according to popular tradition and song, being attributed to Saint Patrick.

ORDER II.—SERPENTS.

OPHIDIA.

THE number of Serpents, like that of other reptiles, increases towards the torrid zone, while comparatively few are found in cold regions. Their bodies are remarkable for great flexibility, caused by the number of joints in the back-bone or “spinal column.”



Fig. 162.—RATTLE-SNAKE.

In the Rattlesnake (*Fig. 162*) these joints amount to about two hundred; and above three hundred have been counted in the spine of the Viper. Some Serpents live amid the foliage of trees, some inhabit fresh waters, some poisonous tribes live in the seas of tropical Asia and New Holland, but by far the greater number are terrestrial. There are at present 265 known species, and of these only 58 are venomous, or not quite one-

fourth of the entire number. This is contrary to popular opinion, and it was especially so in the “olden time.” Thus, whenever Shakspeare mentions one of these animals, it

is always as a creature to be shunned as hateful or venomous:—

“He is a very *serpent* in my way;
And wheresoe’er this foot of mine doth tread,
He lies before me.”

The gigantic Boa-Constrictor belongs to those which are not venomous. It kills its prey by the enormous compression it exerts when coiled round the body of its victim, which it then proceeds to swallow entire.

The poison fangs with which the venomous tribes are furnished, have been described by Professor Jones as “constituting perhaps the most terrible weapons of attack met with in the animal creation.” The poison itself is neither acrid nor burning. On the tongue it only produces a sensation like that of fatty matter, and it may be swallowed without danger; but introduced into the blood in sufficient quantity, it causes death with fearful rapidity, though the power varies, according to the species and other circumstances.

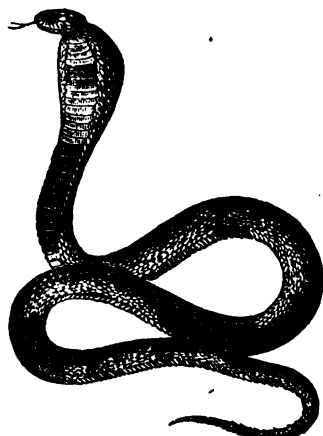


Fig. 163.—EGYPTIAN NAJA.

The Naja or Asp (*Fig. 163*) is a species much used at the present time by the Egyptian jugglers in their exhibitions; it

is one which also possesses a classical and historical interest, associated as it is with the death of Cleopatra.

No Snakes of any kind whatever exist in Ireland. In England, the harmless tribes are represented by the Common or Ringed Snake, and the venomous by the Adder, or Common Viper. The injurious results of the bite of the latter reptile would appear to be much exaggerated. Professor Bell states that he has never seen a case which terminated in death, nor has he been able to trace to an authentic source the numerous reports of such a termination. Both species lie torpid during the winter, and continue so until the return of a more genial season and a higher temperature again rouses them to activity. Hence the remark of the poet,—

“It is the bright day that brings forth the adder,
And that craves wary walking.”—SHAKESPEARE.

ORDER III.—LIZARDS.

SAURIA.

Gay Lizards glittering on the walls,
Of ruined shrines, busy and bright,
As they were all alive with light.—MOORE.

IN this order the body and tail are elongated, the jaws are furnished with teeth, the skin is covered with scales, and the animals have generally four feet. The flesh of many of the foreign Lizards when cooked is white, and is relished

as very good food. Humboldt has remarked that all the South American species within the tropics, and inhabiting dry regions, are esteemed as delicacies for the table.

The genus which comprises the greatest number of species is that of the Iguanas, which are found only in the New World, and live among the branches of trees. Some of them measure so much as five feet in length, and their colour is a beautiful green of a variety of shades. They have a singular crest along the back, and under the chin a hanging pouch which they can inflate with air.

The Geckos or nocturnal Lizards, have a peculiar structure of the feet, by means of which they are enabled to ascend walls, and can even run along ceilings.

Perhaps, however, there are no reptiles which excite a greater degree of popular interest than the Chameleon (*Fig. 164*). They are exclusively na-



FIG. 164.—CHAMELEON.

tives of the warm parts of the Old World, and exhibit several peculiarities of structure. Like other Lizards, they have

five toes; but they are divided into two parcels, and thus adapted for climbing. The tail also serves as an instrument for grasping. The eyes have such independent powers of motion, that they can be turned in the most opposite directions at the same time. The tongue is of great length, and is darted out with unerring aim at their insect prey.

The singular changes of colour for which they have been so celebrated, do not prevail to the extent set forth in a well-known poetical composition with which every school-boy is familiar. They are, however, sufficiently curious to have induced naturalists to endeavour to explain how they were effected. This has only recently been accomplished; and it is found to arise from a singular arrangement of the cells of the skin containing the colouring matter, and precisely similar to that which exists in the Cuttle-fishes.

The Lizards, which are regarded as the true representatives of the order, do not belong to any of the families yet mentioned, but to that to which the two species of English Lizards belong. The facility with which their tails separate from the body is very remarkable, and excites the astonishment of any person unacquainted with this peculiarity.

The following characteristic occurrence is narrated by Dr. J. L. Drummond:—"Being on the sea-shore at Pulo Bay, in Sardinia, and searching for specimens of natural history, I observed a large Lizard running for shelter under a heap of stones. I was just in time to seize it by the end of the tail; but suddenly the resistance made by the animal to my

attempt to drag it from its hiding-place ceased, and I gave it up for lost; but as suddenly had cause for alarm myself, on seeing what appeared to be a small Snake leaping with great agility about my feet, and springing as high as my knee. I instantly started out of its way, and watched it at a respectful distance, when I found that it was the tail of the animal, which I was not before aware could so easily separate."

From the most popular of the Order, we turn to the most formidable, the Crocodiles. Of these, the Alligators or Caymans are peculiar to America, the true Crocodiles to Africa, and the Gavials to Asia. The Crocodile of the Nile formed one of the innumerable idols of the ancient Egyptians. His great strength is almost proverbial. "He esteemeth iron as straw, and brass as rotten wood. The arrow cannot make him flee; sling stones are turned with him into stubble; darts are counted as stubble; he laugheth at the shaking of a spear." Yet this formidable reptile is endowed with habits which render him one of the great benefactors of the human race, for he frequents the banks of tropical rivers, feeds upon the bloated carcasses which come floating down the stream, and thus, by the removal of carrion, prevents the air from being filled with the injurious effluvia of decaying animal matter.

ORDER IV.—TORTOISES.

TESTUDINATA.

“And in his needy shop a tortoise hung,
 An Alligator stuffed, and other skins
 Of ill-shaped fishes.”—SHAKSPEARE.

LET it not excite surprise that in the passage just quoted, the word “fishes” should be applied to reptiles. It is still used by the uneducated in speaking of warm-blooded animals which, like the Whale, live in the sea.

Tortoises are distinguished from all other reptiles by having the body enclosed between two shields, with apertures for the head, the tail, and the four legs. The jaws are horny and without teeth. They may be conveniently arranged with reference to their habits, as Land Tortoises, Fresh-water Tortoises, and Turtles or Marine Tortoises.

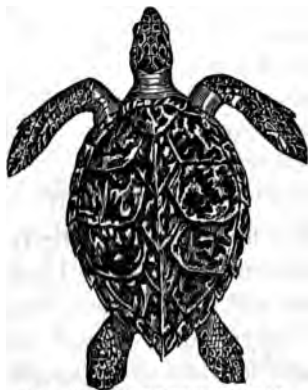


Fig. 165.—HAWK'S-BILL TURTLE.

Among the latter are the Green Turtle, which is so highly prized, by epicures, and the Hawk's-bill Turtle (*Fig. 165*), which supplies the valuable substance known as the Tortoise-shell of commerce. The form of the body is admirably adapted for progress.

through the water, and the feet are formed into oars of the most perfect construction; so that the ease and celerity of the motions of the animal in the water remind the spectator of the progress of a bird through the air.

Various species of marine Turtles resort annually in immense numbers to the island of Ascension, and the shores of the Gulf of Florida, for the purpose of depositing their eggs in holes, which they scrape on the beach for that purpose. The poet thus describes the scene:—

“The pregnant Turtle, stealing out at eve,
With anxious eye and trembling heart, explored
The loneliest coves, and in the loose warm sand
Deposited her eggs, which the sun hatch’d;
Hence the young brood, that never knew a parent,
Unburrowed, and by instinct sought the sea:
Nature herself, with her own gentle hand,
Dropping them, one by one, into the flood,
And laughing to behold their antic joy,
When launched in their maternal element.”

MONTGOMERY’S “PELICAN ISLAND.”

The River Tortoises have webbed feet, and are entirely carnivorous, living upon flesh of various kinds. The Land Tortoises (*Fig.* 166, 167) have feet with short claws, and are altogether herbivorous, or, in other words, subsist on vegetable food. They are remarkable for their great length of life; and also for the weight which they can carry with apparent ease.

Mr. Darwin mentions the great abundance of Tortoises in all the islands of the Galapagos Archipelago. These creatures sometimes grow to an immense size; he had been told of some so large that six or eight men were required to lift them from the ground. They are fond of water, travel

LAND TORTOISES.



166.—Upper Surface.



167.—Lower Surface.

great distances for it to springs on the elevated grounds, and drink large quantities. From this circumstance, it occasionally happens that the inhabitants of the lower district, when overcome with thirst, will kill a Tortoise for the sake of the contained

water. "They believe," says Mr. Darwin, "that these animals are absolutely deaf; certainly they do not hear a person walking close behind them. I was always amused, when overtaking one of these great monsters, as it was quietly pacing along, to see how suddenly, the instant I passed, it would draw in its head and legs, and, uttering a deep hiss, fall to the ground with a heavy sound, as if struck dead. I frequently got on their backs, and then, upon giving a few raps on the hinder part of the shell, they would rise up and walk away; but I found it very difficult to keep my balance."

CLASS III.—BIRDS.

AVES.

“Birds, the free tenants of land, air, and ocean—
Their forms all symmetry, their motions grace.”

JAMES MONTGOMERY.

BIRDS are warm-blooded animals, and are produced from eggs. They breathe by lungs, have a heart consisting of four cavities, and a body covered with feathers.

Connected with the higher organization, we see in birds the power of flight in its fullest development. This alone would separate them from any other class of vertebrate animals. It is, of itself, a singular and interesting subject, connected with the feathered tribes. The entire framework of the body shows a beautiful arrangement having reference to this object, and combining strength, flexibility, and lightness.

The bones of the Eagle, the Swallow, and all others possessed of great powers of flight, are hollow, and can at the pleasure of the bird be filled with air; and as the blood in their bodies is warmer than that of man, the air is particularly buoyant. Birds, too, are furnished with a covering of feathers, which forms their appropriate and peculiar vest-

ment, and presents every possible variety of tint and texture. Well have they been described by the poet:—

“In plumage delicate and beautiful,
Thick without burthen, close as fishes’ scales,
Or loose as full-blown poppies to the breeze;
With wings that might have had a soul within them,
They bore their owners by such sweet enchantment.”

MONTGOMERY’S “PELICAN ISLAND.”

An illustration of the buoyancy of birds, and the power of their descent, is furnished by the Gannet or Solan:

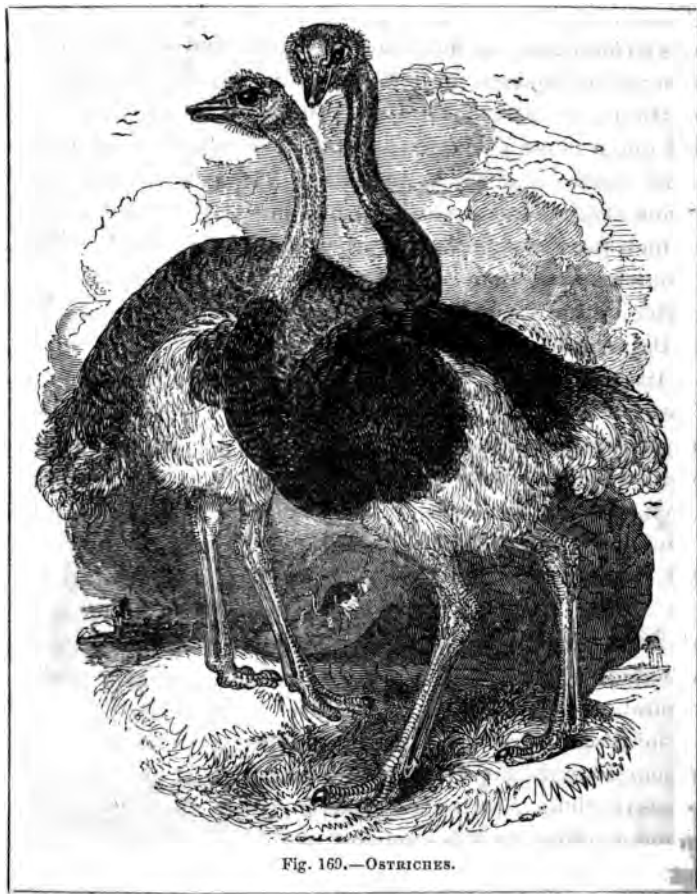


Fig. 168.—GANNET.

Goose (*Fig. 168*) of our own shores. When searching for food it flies a short way above the surface of the water; and

seeing a fish, it rises into the air, and descends with such rapidity and force as to secure the prey. Some idea of the power of its descent may be formed from a circumstance related by Pennant. One of these birds, flying over Penzance, saw some Pilchards spread out upon a fir plank about an inch and a half thick, and which was used in the curing of the fish, and darted down with such violence that it struck its bill quite through the board, and broke its neck. Pennant adds, that these birds are sometimes taken at sea by a similar deception, a fish being fastened for the purpose to a floating plank.

The stomach of birds differs greatly according to the nature of their food. In those which live on flesh it is thin and membranous, but in others the sides are of great thickness, and being moved by powerful muscles, act as a mill in grinding down the food. The stomach in this thickened state is well known as the gizzard, and its action is aided by small pebbles, and other hard substances, swallowed by the bird. This instinctive action is one well known in our common barn-door fowl; and in the Ostrich (*Fig. 169*) it prevails to such an extent, that in the stomach of one were found pebbles enough to fill a large glass bottle. As this bird will swallow metals with equal readiness, popular credulity, in former times, went so far as to assign to it the power of digesting these substances; and many are the allusions in the older writers to this supposed power of "the iron-eating Ostrich."



Birds possess in a high degree the sense of sight; and the eye is so admirably adapted to their wants, that it is suited for vision at the great height to which birds soar, and no less fitted for vision near at hand. It has *three*, not *two* eyelids; the third one, when not in use, lies in the inner angle of the eye.

The sense of smell is also very highly developed, and various experiments have been tried to ascertain the extent to which it exists in different species. It has been a matter of controversy whether Vultures are guided to the carrion on which they feed by the sense of sight or that of smell; but there seems no good reason for doubting that both senses are made to contribute to the welfare of the birds by directing them to their prey. The far-sighted eye sees it from the clouds, and the characteristic flight of the Vulture, as it descends to the feast, reveals to its brethren the fact that a repast is spread for them; and from all quarters they hasten to participate. And, again, when near at hand, under the screen of cliffs, or the thick-tangled vegetation of tropical forests, the sense of smell reveals the hidden carcass, and tempts around it those who act an important part as agents for its removal.



Fig. 170.—POUCHED ADJUTANT.

There are many other birds which, like the Vultures, assist in freeing the surface of the earth from decaying animal matter. Thus, in India, there is one whose services are no less valuable, a gigantic kind of Crane, called the Adjutant (*Fig. 170*). This bird is of such utility as a scavenger, that it is not only permitted to remain unmolested, but it is held in great estimation, and even regarded with reverence. It is a voracious feeder, and gulps down its food whole. It has been known to swallow a leg of mutton of five or six pounds weight; and Sir Everard Home states, that in the stomach of one, a Land Tortoise ten inches long, and a large black Cat, were found entire.

Migration.—At the approach of winter, there are various birds which make their appearance pretty nearly at the same time each year, and leave us early in the spring. They have arrived from regions further north, and have made our islands the *southern* limit of that periodical change of residence to which we give the term migration. There are others whose appearance in spring we welcome, not only because of the beauty of their flight or their plumage, or the cheerfulness of their notes, but as the heralds of brighter skies, and returning verdure. These stay with us during the summer, and then wing their way to the south. The British islands constitute the northern limit of their migration. It is now ascertained, that the greater number of these summer birds leave these kingdoms for the north and west of Africa, whence they return every year, with such punct-

tuality, that their appearance may be looked for with confidence, within a day or two of the customary time.

These simple facts are nearly all we can be said to know with certainty upon the subject. We can give no satisfactory explanation of their cause, and should therefore candidly admit our ignorance. The truest philosophy is to look upon birds as acting under an impulse implanted in their constitution by the Creator, and winging their flight under His guidance. Such a reflection will make us listen with higher pleasure to the voice of the Cuckoo, and look with increased interest on the graceful flight of the Swallow. The experience of every day teaches that "the Stork in the heavens knoweth her appointed times, and the Turtle and the Crane (*Fig. 171*) and the Swallow observe the time of their coming."

Nests and Young.—The nests of our native birds exhibit great diversity in situation, structure, and materials. Some of those belonging to foreign countries appear even more ingenious and artistical, though of course not better adapted to the wants of their respective occupants. Thus, the nests of the Baya, a bird of Hindostan,



Fig. 171.—CRANE.

are formed of long grass woven together in the shape of a bottle (*Fig. 172*), and suspended to the extremity



Fig. 172.—NEST OF THE BAYA.



Fig. 173.—NEST OF THE TAILOR-BIRD.

of a flexible branch, the more effectually to secure the eggs and young brood from serpents, monkeys, squirrels, and birds of prey. These nests contain several apartments, appropriated to different purposes.

Another species, called, with great justice, the Tailor-bird, collects, from the cotton-plant, fibres of cotton, and with them sews two leaves together, the bill being used as a

needle. The nest is concealed in the space between the two leaves (*Fig. 173*).

When the nests evince so much skill and labour in their construction, it may well be supposed that the young, for whose especial use they are formed, are not neglected; and in point of fact they are objects of the most incessant care. The attention bestowed upon them is so continual, and so full of tenderness, that it is not in the power of language to convey a more vivid idea of affectionate solicitude, than is implied by a simple reference to their ordinary habits.* We can feel, therefore, the truth and beauty of the picture given by the poet:—

- "In hollow trees, or thickets, these concealed
 Their exquisitely woven nests, where lay
 Their callow offspring, quiet as the down
 On their own breasts, till from her search the dam
 With laden bill returned, and shared the meal
 Among her clamorous suppliants all agape;
 Then, cowering o'er them with expanded wings,
 She felt how sweet it is to be a mother."

MONTGOMERY'S "PELICAN ISLAND."

According to the most recent authority upon the subject, there are about 5,000 different species of birds known to na-

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 "O Jerusalem, Jerusalem! which killest the prophets, and stonest them that are sent unto thee: how often would I have gathered thy children together, *as a hen doth gather her brood under her wings*, and ye would not!"—LUKE xiii, 34.

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III.—OWLS.—STRIGIDÆ.

“The Owl shriek’d at thy birth, an evil sign.”—SHAKESPEARE.

THE nocturnal birds of prey form the third and last division of the present order, and constitute the well-marked family of the Owls. In the dusk of the evening they sally forth, with eyes eminently adapted for the diminished light, and with wings whose movement is so inaudible, that, to use the words of an eloquent writer, “a flake of snow is not winnowed through the air more softly silent.” Their strange appearance, grotesque attitudes, discordant screams, or continuous hootings, have made them be regarded by the uneducated as birds of ill omen, and accordingly they are frequently referred to as such by our poets. The progress of knowledge dispels these idle fears, and converts what was a cause of terror into a source of poetic association.

Owls differ much in dimensions, some even approaching in size to the Eagles. Among these, the Snowy Owl (*Fig. 180*) stands conspicuous; it is a native of high northern latitudes, but has been taken on many occasions in these countries. It flies abroad in the day time as well as in the twilight, and has greater swiftness when on the wing than any other member of the family. It feeds almost indiscriminately on birds, quadrupeds, fishes, and even carrion; and can swallow entire animals of the size of a grouse or a young rabbit.

In these particulars it presents quite a contrast to the

habits of the White or Barn Owl (*Fig. 181*), our most common native species. These birds frequent unoccupied buildings of any kind. The "ivy-mantled tower" is a congenial abode. They leave their retreat about an hour before sun-



Fig. 180.—SNOWY OWL.

set, to hunt for mice, which form the principal food of themselves and their young; and in doing so, they "beat the fields over like a setting-dog." The numbers of mice destroyed by a breeding pair of Owls must be enormous, and the service they thus perform very great to the farmer, the planter, and the gardener. In one instance, where the Owls had been nearly destroyed by means of pole-traps placed

about the fields, rats and mice increased to such an extent, and committed such havoc, that the proprietor was obliged to have all the pole-traps taken down; and the Owls being allowed to increase again, the number of rats and mice as quickly diminished.



Fig. 181.—BARN OWL.

Mr. Thompson mentions that a pair of White Owls had their nest and young in a loft appropriated to pigeons, in the town of Belfast. On the shelf, beside the young Owls, the number of dead mice and rats observed remaining after the night's repast, varied from six to fifteen. The Owls made no attempt to molest either the pigeons or their young; and there is strong reason to believe that it is only in the dearth of other prey, that this Owl attacks any of the feathered tribe.

ORDER II.—PERCHING BIRDS.

INSESSORES.

“The ousel-cock,* so black of hue,
 With orange-tawny bill:
 The throistle, with his note so true;
 The wren, with little quill;
 The finch, the sparrow, and the lark;
 The plain-song cuckoo grey.”—SHAKESPEARE.

IN consequence of the great number of species comprised in the present order, it is divided into four groups, and these are again subdivided into families, genera, and species. The four groups are distinguished by characters, connected with the form of the beak or of the foot. Those birds which, like the Thrush and the Robin, have on the upper mandible of the bill a notch or tooth (*Fig. 182*), constitute the group of tooth-billed birds. Those which, like the Sparrow, have the bill of a conical shape (*Fig. 183*), form another group. The third consists of those which are remarkable for their powers of climbing. In them the toes are most usually arranged in pairs, two turned forwards and two backwards, as may be seen in the foot of the Cuckoo or



Fig. 182.



Fig. 183.

* The Blackbird is here referred to.

Woodpecker (*Fig. 190*). The fourth is composed of those birds whose beak is so wide and gaping that it appears as if cleft; the Swallow and the Swift are familiar examples of this structure. It may also be observed in the Goat-sucker (*Fig. 184*), a bird which popular credulity has accused in Italy of sucking goats, and here of sucking cows, and inflicting a fatal distemper upon weaning calves. We have thus four tribes of perching birds:



Fig. 184.

- I. Tooth-billed, *Dentirostres*.
- II. Conical-billed, *Conirostres*.
- III. Climbers, *Scansores*.
- IV. Gaping-billed, *Fissirostres*.

TRIBE I.—TOOTH-BILLED BIRDS.

“Brisk Robin seeks a kindlier home;
 Not like a beggar is he come,
 But enters as a looked-for guest,
 Confiding in his ruddy breast.”—WORDSWORTH.

THE family of the Thrushes includes the Water Ouzel, the Missil Thrush, and the Fieldfare, a migratory species, that arrives from the north in the month of October, and remains here in large flocks during the winter. Two species are, however, particularly celebrated for their powers of song.

namely, the Song Thrush and the Blackbird, "the Mavis and Merle" of the Border Ballads.

The next family contains, however, one species which is considered to stand pre-eminent in all the requisites for first-rate song—the Nightingale. The notes of woe which poets have attributed to this bird are altogether fanciful; the song, in reality, is not the expression of sorrow, but that of joy; and it proceeds not from the female bird but from the male, who thus woos his mate, or cheers her in the performance of her maternal duties.

To the same family belongs the Robin Redbreast, a bird that above all others appeals to our sympathies, associated as it is with recollections which the wear and tear of after life can never efface. Those who have lived in this country have seen him during the summer feeding on earthworms, caterpillars, berries, and fruits, and in winter presenting himself to receive from the hand of man that food which the frozen earth withholds. His habits, when he first ventures into the cottage to pick up the proffered crumbs, have been truly described by Thomson:—

—————"Then hopping o'er the floor,
Eyes all the smiling family askance,
And pecks, and starts, and wonders where he is."

This bird seems at times to have indulged some whimsical fancies as to the situation of his nest. "A pair took up their abode in the parish church of Hampton, in Warwickshire, and affixed their nest to the church Bible, as it lay on the

reading-desk. The vicar would not allow the birds to be disturbed, and therefore supplied himself with another Bible, from which he read the lessons of the service." Mr. Thompson records a more extraordinary selection, made by one which had been frequently expelled from a bird-stuffing room when the window was kept open. Finding expulsion



Fig. 185.—HUMMING-BIRD.

of no avail, the gentleman to whom the room belonged had recourse to a novel, and rather comical expedient.— From his collection of stuffed Asiatic quadrupeds, he selected some of the most fierce-looking, and placed them at the open window, which they nearly filled, in hopes that their formidable aspect might deter the bird from entering; but the Redbreast was not to be so frightened, and went in as usual. It was at length allowed to have its own way, and, as if to mark its contempt of all such stratagems, the place chosen for the nest was the head of a Shark!

This may be the proper place to allude to those tropical birds which are remarkable for their slender bills. This peculiarity is well exhibited in the Humming-birds (*Fig. 185*), a tribe which includes some of the smallest and ~~most~~

beautiful of the whole feathered race, combining the richness of flowers, and the brilliancy of gems. They take their name from the manner in which they hover over flowers, keeping up a humming noise by the vibration of their wings, the motion of which at such times is so rapid, as to be scarcely visible.

TRIBE II.—CONICAL-BILLED BIRDS—CONIROSTRES.

“The Daw,
The Rook and Magpie, to the grey-grown oaks
* * * direct their lazy flight.”—THOMSON.

THE Lark is not a good example of the peculiarities of structure by which the present group is distinguished: but it is the bird to which we listen with “ever-new delight,” when in early spring it pours down a flood of music on the earth, or when we hearken to the cheerful influence of its song as described by Milton:—

“To hear the Lark begin his flight,
And singing startle the dull night;
From his watch-tower in the skies,
'Till the dappled morn doth rise,
Then to come in spite of sorrow,
And at my window bid good-morrow.”

The Lark is universally distributed over Europe, and verses addressed to this ‘messenger of morn,’ are every where current.

The common Starling (*Fig. 186*) is the representative of another family belonging to the same tribe. It is well known for its power of imitating sounds; and from an early age has in some minds been associated with Sterne's well known words, "I cannot get out." It is a migratory



Fig. 186.—STARLING.

species, and in some localities assembles not only by thousands but even by millions. A large body of them, estimated at 150,000 or 200,000, paid the Zoologists of Dublin the compliment of taking up their quarters in a mass of thorn-trees at the upper end of the Zoological Garden in the Phoenix Park. Mr. Ball, the Secretary of the Society,

described the Starlings, in 1845, as sleeping there every night from the end of October to about the end of March. They have now nearly abandoned the locality, in consequence of their having been disturbed.

This is perhaps the place where reference may be made to the Birds of Paradise (*Fig. 187*), which, according to eastern fable, lived upon dew and vapour, and carried on without descending to earth all the functions of life, even to the production of their eggs and young. They have justly been said, from the extreme beauty of their plumage, to hold the highest rank among the feathered glories of the creation. They are limited to New Guinea, or as it is frequently called, the country of the Papuas, and some of the adjacent islands of the South Pacific Ocean. The natives of these countries, when preparing and drying the skins, were in the habit of removing the feet of the bird. The skins in this state were sold to the Malays, carried into India, and thence conveyed into Europe. Here we have the origin of the superstitious ideas with which these birds were formerly associated, arising from their supposed want of legs. The legend has been commemorated by Linnæus, who applied to the best known



Fig. 187.—BIRD OF PARADISE.

species the appellation, "footless;" and it has been enshrined in the harmonious lines of the poet:—

——— "The footless fowl of heaven that never
Rest upon earth, but on the wing for ever,
Hovering o'er flowers their fragrant food inhale,
 Drink the descending dew upon its way,
And sleep aloft while floating on the gale."

SOUTHEY'S "CURSE OF KEHAMA."

The Rook may be regarded as the representative of another family, which includes the Raven, the Magpie, and the Jay. The Rook is a social bird, fond of living about the abodes of man, and even of building in the heart of crowded cities. But it is not with such haunts that its appearance is usually associated, but with time-honoured mansions, and more especially lofty trees, their chosen abodes during successive generations.

Washington Irving has written respecting these birds, in his usual agreeable style. "They are," he says, "old established housekeepers, high-minded gentlefolk, that have had their hereditary abodes time out of mind;" and he goes on in the same amusing manner to describe, what "rather derogates from the grave and honourable character of these ancient gentlefolk, that, during the architectural season, they are subject to great dissensions among themselves; that they make no scruple to defraud and plunder each other, and that sometimes the rookery is a scene of hideous

brawl and commotion, in consequence of some delinquency of the kind."

It has been a question whether the rook should be regarded by the farmer as a friend or an enemy; and it is the opinion of those who have most carefully examined the evidence on both sides, that the continual benefit which Rooks confer, by the destruction of snails, worms, and insects, far more than compensates for any occasional injury they inflict. There are numerous insects that, in the caterpillar state, eat away the roots of grain or grass crops, while others in different stages make their attacks above ground, and at a later season. The larvæ of the Cockchafer, of the Click Beetles, and of the Harry-longlegs, are all underground feeders; and sometimes when Rooks pull up grass and scatter it about, its roots have been already destroyed by the unseen devastators for which the birds are searching. "A gentleman," says Mr. Jesse, "once showed me a field which had all the appearance of being scorched as if by a burning sun in dry hot weather. The turf peeled from the ground as if



Fig. 188.—HORNBILL.

it had been cut with a turfing-spade, and we then discovered that the roots of the grass had been eaten away by the larvæ of the Cockchafer, which were found in countless numbers at various depths in the soil." The Rooks, which evince remarkable quickness in detecting such spots, were in reality benefactors, not destroyers. Numerous other examples of a similar kind might be brought forward.

There are some foreign birds which, in their general habits, approach to the present family. They are remarkable for the excrescence by which the beak is surmounted, and from which they derive their name of Hornbills (*Fig.* 188). This singular appendage is extremely light, consisting of numerous cells filled with air, which in fact penetrates with great ease every part of their skeleton.

TRIBE III.—CLIMBING BIRDS—SCANSORES.

"In gaudy robes of many colour'd patches,
The Parrots swung like blossoms on the trees,
While their harsh voices undeceived the ear."—J. MONTGOMERY.

No better examples can be given of climbing birds than the Parrots, Cockatoos, and Macaws (*Fig.* 189) of tropical countries; those beautiful birds, many of which are domesticated in our houses, and which are uniformly one of the principal points of attraction in our Zoological Gardens. The formation of the foot and of the beak, qualify them in a pre-eminent degree to act as climbing birds.

The Woodpeckers (*Fig. 190*) are examples of British birds, belonging to the present group. Their food consists of insects in different states, for which they search under the bark of trees, digging into the wood of such as are decayed.



Fig. 189—MACAW.



Fig 190.—WOODPECKER.

The Wren, a favourite little bird, remarkable both for its diminutive size and its large family, must here be placed. Also the Cuckoo, which builds no nest of its own, but drops its eggs into the nests of other birds, especially those of the Hedge Sparrow, the Pied Wagtail, and the Meadow Pipit. The young Cuckoo, soon after it has been hatched, throws out of the nest the other young birds, and also the eggs, remaining sole occupant, and securing to its own use the food which the old birds supply. Its joyous call is often referred to by the poets.

TRIBE IV.—GAPING-BILLED BIRDS—FISSIROSTRES.

“This guest of summer
 The temple-haunting Martlet, does approve,
 By his loved mansionry, that the heaven's breath
 Smells wooingly here: no jutting, frieze, buttress,
 Nor coigne of vantage, but this bird hath made
 His pendant bed, and procreant cradle: where they
 Most breed and haunt, I have observed the air
 Is delicate.”—SHAKESPEARE.

THE Kingfisher (*Fig. 191*) is unquestionably superior to all other British birds in the brilliancy of its plumage, and is not surpassed by many of those belonging to tropical countries.



Fig. 191.—KINGFISHER.

It was formerly believed that the Kingfisher, or as it was then termed, the Halcyon, hatched her eggs in a floating nest, and that, during the time she was thus engaged, the winds were at rest, and the sea remained smooth and calm.

This period was therefore called the Halcyon days, and is frequently referred to as such by the poets.

The Goatsuckers having been already mentioned (*page* 184), let us turn to the family of the Swallows.

“The Swallow,” says Sir Humphrey Davy, “is one of my favourite birds, and a rival of the Nightingale, for he cheers my sense of seeing as much as the other does my sense of hearing. He is the glad prophet of the year—the harbinger of the best season: he lives a life of enjoyment amongst the loveliest forms of nature; winter is unknown to him; and he leaves the green meadows of England in autumn for the myrtle and orange groves of Italy, and for the palms of Africa.” The Swallow arrives in these countries about the 10th of April, and remains about six months. The House-martin appears a few days later than the Swallow, a circumstance attributed to its smaller expanse of wing and diminished powers of flight. It is this species which the poet has so beautifully pictured in the motto of the present chapter, and whose nests every one has seen fixed under the eaves of houses and the upper angles of windows.

The Sand-martin or Bank-martin is smaller in size than either of those mentioned, and is the earliest to arrive in these countries. The Swift most usually makes its appearance the first week in May, and departs in August.

An interesting fact has been established, with regard to the House-martins, that they return to their old abodes. Mr. Thompson records an instance in the neighbourhood of Belfast, in which a pair found their nest occupied by a Sparrow, who seemed determined to keep possession. The

Martins departed, returned with about twenty of their kindred, and built up the entrance to the nest, enclosing the offender within. Next morning the pair of Martins commenced the construction of a new nest, against the side of their old one, and in it, undisturbed, reared their brood. After some time the proprietor of the cottage had the curiosity to pull down both nests, and in that retained by the Sparrow found its remains, together with several eggs.

ORDER III.—SCRAPING BIRDS.

RASORES.

“The careful Hen
Calls all her chirping family around,
Fed and defended by the fearless Cock,
Whose breast with ardour flames, as on he walks
Graceful, and crows defiance.”—THOMSON’S “SPRING.”

THE present order includes the common Barn-door Fowl, such as the Cocks, Hens, Pea-fowl, and Turkeys; also the different kinds of Pigeons, Pheasants, Grouse, and Partridge. They are not in general adapted for rapid flight. They have the body bulky, the wings short, the legs robust, and the feet formed for walking;—the feet are also employed in scratching the ground, and thus exposing to view the seeds or other food on which the birds subsist. This habit has given origin to the name by which the order is distinguished.

The figure which is annexed (*Fig. 192*) represents the Wild Turkey of America, from which we derive the well-known bird that struts and gobbles in the farm-yard.

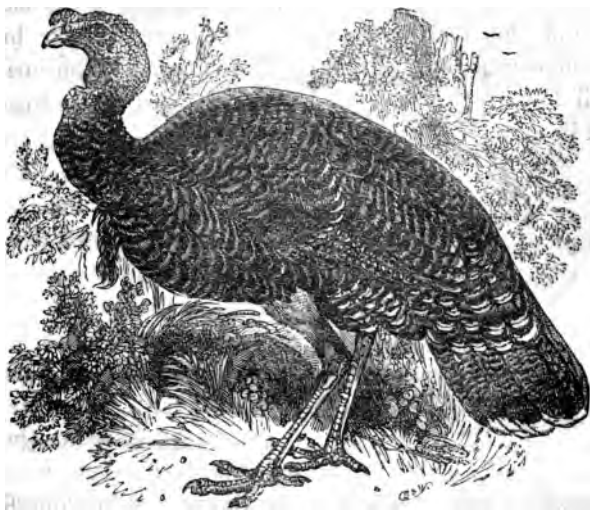


Fig. 192.—WILD TURKEY.

The Doves constitute one well-marked family. The Ring-dove, or Wood-pigeon, is the Cusht of the poets: the Rock-dove is the species from which the varieties of the domestic Pigeon are derived. The Carrier-pigeon, when perfectly trained, is remarkable for the speed with which its journey is accomplished, when no unfavourable circumstances, such as fog, mist, or a strong opposing wind, occur

to retard its course. On one occasion a Carrier-pigeon flew from Rouen to Ghent, a distance of about 150 miles, in an hour and a half. On another, 23 Irish miles were accomplished in eleven minutes; or, in other words, at the rate of $125\frac{1}{2}$ miles an hour.

The common Pheasant belongs to another family, and the Grouse and Partridge to a third. The White Grouse or Ptarmigan (*Fig. 193*), is only found on some of the high mountains of Scotland and the adjacent islands. It is celebrated for the change of colour exhibited by the plumage at different seasons of the year. In summer this so closely resembles the sur-



Fig. 193.—PTARMIGAN.

rounding rocks and lichens, that the bird, when at rest, is scarcely to be distinguished from them; and in winter, it is like the snow-clad mountains.

Sir Walter Scott, therefore, attributes acute powers of vision to Malcolm Græme, when he says:—

“Train’d to the chase, his eagle eye
The Ptarmigan in snow could spy.”

ORDER IV.—WADING BIRDS.

GRALLATORES.

“No more thy glassy brook reflects the day,
 But, chok'd with sedges, works its weedy way;
 Along thy glades, a solitary guest,
 The hollow-sounding Bittern guards its nest:
 Amidst thy desert walks the Lapwing flies,
 And tires their echoes with unvary'd cries.”—GOLDSMITH.

THERE are some birds whose legs are so long, that the body seems as if mounted on a pair of stilts; and this peculiarity is that which is expressed by the scientific name for the present order—a Latin word—literally meaning those who walk on stilts. The lower part of the leg is naked; and from this circumstance, as well as from its length, is especially adapted for wading. Hence, birds of the present order are called “Waders.”

But, although this term is very correct, as applied to some, it is altogether incorrect with regard to others; thus, the Ostrich (*Fig. 169*), which lives remote from the sea, and from the banks of rivers, is included; and birds, which, like the Plover, are not remarkable for great length of leg, are also included. The fact is, that here, as in other great groups, the characteristics must be sought in some which may be looked upon as the representatives of the order, and not be required in every individual that naturalists may place in the same assemblage.

Cuvier arranges, in one family, all the birds of the present



Fig. 194.—APTERYX.

order whose wings are not adapted for flying, as those of the Ostrich (*Fig. 169*). Here, also, is placed the Apteryx of New Zealand (*Fig. 194*), a strange creature, without wings or tail;

with strong legs, claws suited for digging, and actually used in forming the excavations in which this singular bird lays her eggs and hatches her young.

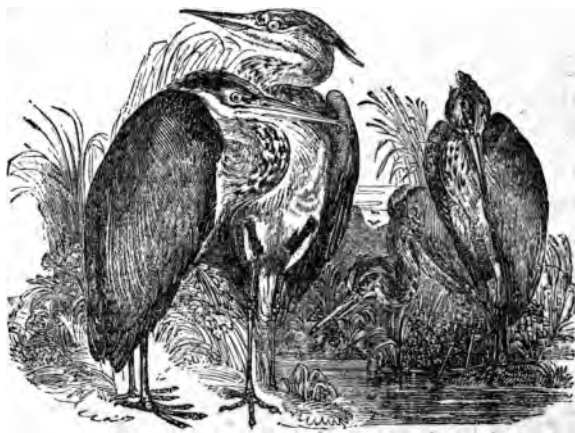


Fig. 195.—COMMON HERON.

The common Heron (*Fig. 195*) is probably one of the ~~best~~ ^{best}.

known birds belonging to the present order. Its motionless attitude, as it watches for its prey in the shallow of the river or the sea, cannot fail to have attracted attention, adding, as it not unfrequently does, to the picturesque effect of the scene. Nor less striking is its appearance on the wing, the long outstretched legs acting as a counterpoise to the head and neck. It is a singular spectacle to behold these birds collecting in spring at their building stations, occupying like Rooks the upper branches of high trees, and beginning once again the important business of incubation. They do not, however, invariably choose such situations, but occasionally select precipitous rocks near the coast.

The bird called the Common Bittern (*Fig. 196*) is no longer a common bird in these countries, and is every year becoming more rare, as waste lands are reclaimed. During the breeding season it utters a loud booming or bellowing noise, to which some of our poets have alluded.



Fig. 196.—BITTERN.

“But the Lark’s shrill life shall come
At the day-break from the fallow,
And the Bittern sound his drum,
Booming from the sedgy shallow.”

Living remote from human haunts, on the marsh, the bog,

and the quagmire, it continues to this day the emblem of desolation and solitude, as it was at the time when the Prophet proclaimed against Babylon the awful denunciation; "I will also make it a possession for the Bittern, and pools of water; and I will sweep it with the besom of destruction," saith the LORD of hosts."

The White Stork (*Fig. 197*) is another member of the

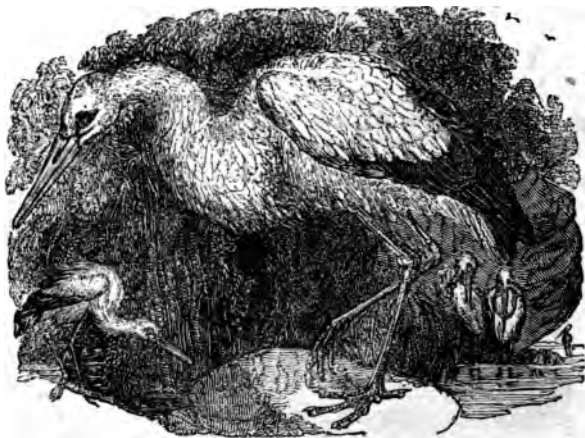


Fig. 197.—WHITE STORK.

same family that must not be passed by without mention. Those who have travelled in Holland, and other parts of the continent, know the favourable light in which it is regarded, and the arrangements made for its accommodation and protection. The affection of the Stork for its young, is one of the most remarkable traits in its character; it is only needful

to refer to the female which, at the conflagration of Delft, after several unavailing attempts to remove her young, chose to remain and perish with them, rather than leave them to their fate. Among the ancient Egyptians, the Stork was regarded with reverence inferior only to that which was paid to the Sacred Ibis—another member of the present family.

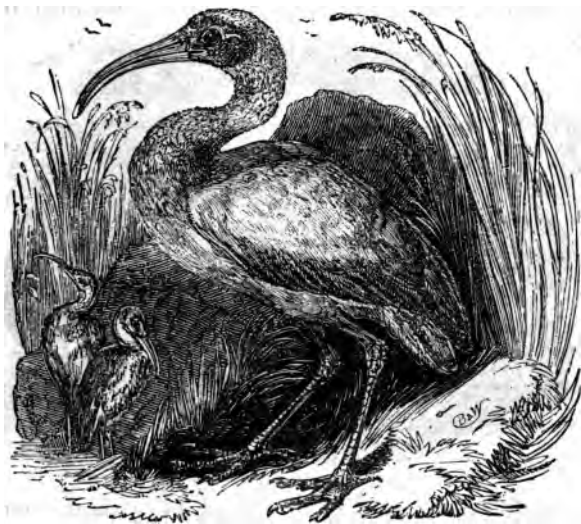


Fig. 198.—SCARLET IBIS.

The Ibis was at one time the object of a nation's worship, and its remains are still preserved as mummies in the Egyptian tombs. The Scarlet Ibis (*Fig. 198*), one of the most splendid of birds, is a native of the tropical regions of America.

ORDER V.—SWIMMING BIRDS.

NATATORES.

“Some sought their food among the finny shoals,
 Swift darting from the clouds, emerging soon
 With slender captives glittering in their beaks.”—**PELICAN ISLAND.**

In the birds of this order the bill is variously shaped. The legs short; often placed far behind, adapted for swimming.

From the great extent of coast, and the varied character

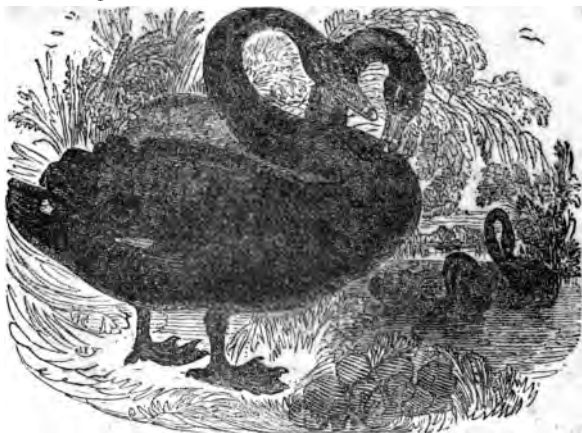


Fig. 199.—BLACK SWAN.

of the British Islands, the birds of the present order are so numerous as to constitute more than one-fourth of the entire of the native species. They are arranged in five families:—

I. The first of these comprises Geese, Swans, and Ducks. The domesticated Swan is, in these countries, the species most generally admired. Who is there who has not paused to gaze upon her arched neck, her graceful swimming movement, and her snowy plumage? It was no wonder that a classic writer referred to Black Swans, in such a manner as to imply his entire disbelief of their existence. Yet Black Swans (*Fig. 199*) are among those strange creatures, that have been sent to us from New Holland. They



Fig. 200.—GREAT NORTHERN DIVER.

are now distributed over the kingdom, wherever there are menageries of aquatic birds, and form a striking contrast to the snowy tint of the other species.

II. The grebes and the Divers constitute the second family; and a glance at the annexed figure of the Great Northern Diver (*Fig. 200*) will convey a better idea of their aspect than any verbal description. The Divers, as their name implies, are remarkable for their diving powers, thus pursuing their prey, and evading their enemies. The bird figured is a winter visitant, and belongs to a species which may be said to live upon the water, except during the time devoted to the rearing of the young.



Fig. 201.—PENGUIN.

III. In the third family is placed the Puffin, a bird common around the coast during the summer months, and from the form of its bill, called “Sea-Parrot and Coulter-neb.” Here also must be arranged the Penguin (*Fig. 201*), whose singular plumage reminds us rather of the scale of the fish than the feathers of a bird. The wings, so powerless for flight, are, however, most efficient as fins. When at sea and fishing, it comes to the surface, for the purpose of breathing, with such a spring, and dives again so instantaneously, that no one could at first sight be sure it was not a fish leaping for sport.

IV. The fourth family is that of the Pelicans. The Pelican is remarkable for the membranous bag attached to the

under side of the bill (*Fig. 202*), and capacious enough to hold a good store of fish. The only native birds belonging to this family are the Gannet or Solan Goose (*Fig. 168*), and two species of Cormorant.

V. The fifth family comprises the Terns, Gulls, and Petrels.

The Terns (*Fig. 203*) are also called sea-swallows, a

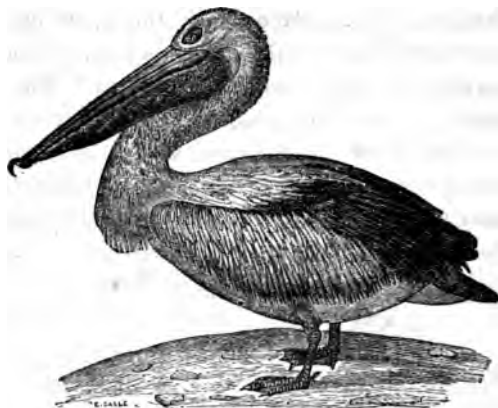


Fig. 202.—PELICAN.



Fig. 203.—TERN.

term denoting ease and rapidity of flight, and some resem-

blance to the Swallow in other respects, among which the long forked tail is perhaps the most striking. They live upon small fish, and flying some yards above the water, dart down with such quickness and precision as rarely to miss the object of their aim.

The Gulls are, however, better known than either of the other tribes. The mariner finds them in all seas; and the landsman who visits the coast cannot fail to remark their graceful flight, the buoyant ease with which they ride upon the waves, and the animation which they give to the scene. Perhaps few ordinary occurrences are more striking than what is termed a "play of gulls;" when the birds, having discovered a shoal of young fish, are swimming among them, hovering over them, uttering wild screams of joy, plunging down into the midst of the shoal, and gorging their prey with riotous delight.

In the building of the nests, gulls do not confine themselves to the rocks and cliffs of the sea-shore; many retired inland localities are favourite places of resort. In Norfolk, at a distance of thirty miles from the sea, thousands of the Black-headed Gull (*Fig. 204*) annually take possession of an island of about thirty acres in extent, and build their nests. In the north of Ireland, the Black-headed Gulls frequent the gravelly beach of a portion of Ram's Island in Lough Neagh, for the same purpose.

Of the Petrels, the best known species is that which is the smallest of British web-footed birds, the Stormy Petrel.

They crowd round vessels before and during stormy weather, partly for the sake, it is supposed, of shelter, and partly for



Fig. 204.—BLACK-HEADED GULL.

that of food. Sailors regard them with superstitious feelings, and have long given them the name of “Mother Carey’s chickens,” from some hag of the olden time, whose name would have passed into oblivion had it not been associated with those harmless little birds. Their dusky plumage, diminutive size, their habit of running upon the surface of the water, and the circumstances under which the mariner sees them, account very naturally for the feelings with which he regards them.

CLASS IV.—MAMMALIA.

QUADRUPEDS, WHALES, BATS, MONKEYS, &c.

WE have now reached the highest class in the animal kingdom, that class to which man himself belongs. Here only

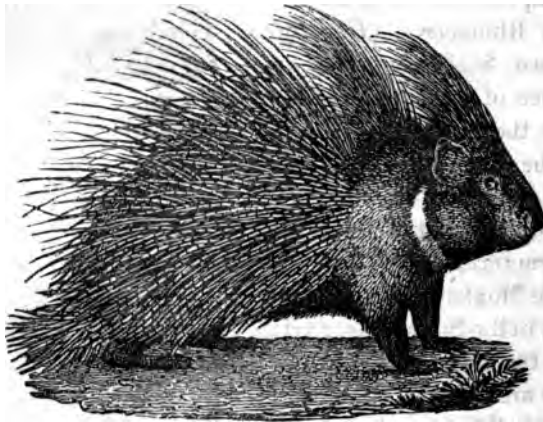


Fig. 203.—PORCUPINE.

do we find organs for supplying to the young, during infancy, that fluid nutriment to which we give the name of ~~milk~~ ^{mother's milk}.

Every animal that suckles its young may, from that circumstances, be referred to the present class. They all have warm blood, and breathe by lungs.

While scales form the characteristic covering of fishes, and feathers of birds, hair may be said to be that of the Mammalia. It is not invariably present, and it undergoes many modifications in its appearance. We term it wool upon the sheep; the same material becomes spines upon the Hedgehog, and quills upon the Porcupine (*Fig. 205*). It is converted into bony plates in the defensive covering of the Armadillo (*Fig. 217*); and in the weapon with which the nose of the Rhinoceros (*Fig. 206*) is armed, it presents the appearance of solid horn, adhering to the skin, not growing from the skull.



Fig. 206.—RHINOCEROS.

The greater number of the animals of this class possess four feet, which are used for the purpose of locomotion; but this structure, though general, is by no means universal. In the true Monkeys (*Fig. 246*) all the extremities are shaped like hands; in the Seals (*Fig. 232*) they are converted into paddles; and in the Bats (*Fig. 240*), the bones which correspond to our fingers are so long, as to form the framework of the wings.

Great difference is found to prevail with regard to the number, form, and arrangement of the teeth. Farther examination shows that the teeth vary in these particulars,

according as the food of the animal is to consist of soft flesh, or of horny-covered insects; of tender herbs, or of firm wood. And so entirely is one part of the bodily frame made to correspond with another, that it is perfectly possible, merely by an inspection of the teeth, to determine, with considerable certainty, the diet, the habits, and even the general structure of most of the Mammalia.

Hence the teeth, viewed in connection with the form of the extremities, furnish, so far as external characters are concerned, a sound basis for classification. As such they were regarded by Cuvier; and the principles he laid down have been adopted by succeeding naturalists, though some differences have existed as to some of the details.

According to the following arrangement, the inferior animals are divided into ten Orders. To these man must be added, constituting another Order of which he is the sole representative, and making eleven Orders in all.*

* They may be thus enumerated:—

I. Bimana	(two-handed)	Man.
II. Quadrumana	(four-handed)	Monkeys.
III. Chiroptera	(finger-winged)	Bats.
IV. Insectivora	(insect-eating)	Hedge-hog, Shrew.
V. Carnivora	(flesh-eating)	Lion, Tiger, Bear.
VI. Cetacea	(whale-like)	Whale, Porpoise.
VII. Pachydermata	(thick-skinned)	Elephant, Rhinoceros.
VIII. Ruminantia	(ruminating)	Ox, Deer.
IX. Edentata	(toothless)	Sloth, Ant-eater.
X. Rodentia	(gnawing)	Rat, Hare, Squirrel.
XI. Marsupialia	(pouched)	Opossum, Kangaroo.

Each of these shall now in turn be briefly noticed, commencing with those which are lowest in the scale, and gradually ascending to man, who has been gifted with dominion "over every living thing that moveth upon the earth."

MARSUPIAL OR POUCHED ANIMALS.

MARSUPIATA.

"Deform'd, unfinish'd, sent before my time

Into this breathing world, scarce half made up."—SHAKESPEARE.

THE present Order derives its scientific name from the circumstance of the female, in most instances, being furnished with a peculiar pouch,* in which the immature young are received and nourished, and to which they retreat for safety. The Kangaroos and Opossums are familiar examples.

The Kangaroos of Australia are vegetable-feeding animals, which browse upon herbage like oxen, and in some cases chew the cud as they do. Some of them, when in their common erect position (*Fig. 207*), are nearly as tall as a man; others, both in size and general appearance, resemble the com-

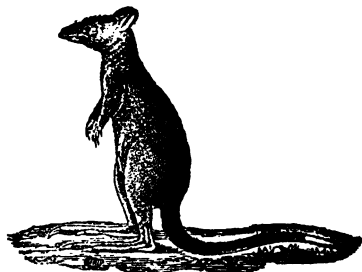


Fig. 207.—KANGAROO.

* Latin *marsupium*, a pouch or bag.

mon Hare. On one occasion, at the Surrey Zoological Gardens, I noticed on the abdomen of a large bluish-grey coloured Kangaroo, two appendages, which were in fact the fore-feet of the young one appearing outside of the pouch. In another moment the head peeped out, and the young creature began gazing around. The mother then bent down, and with great tenderness began licking its face and head. These endearments being finished, the young one came out and was amusing itself on the ground, when, alarmed by a sudden noise, it jumped into the pouch and was seen no more!

The Opossums are peculiar to America; most of them

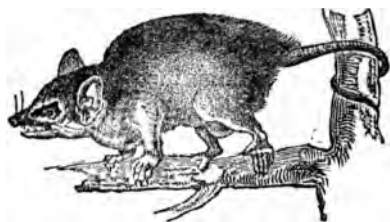


Fig. 208.—OPOSSUM.

are but little larger than the common rat; a few approach in size to the domestic cat. The feet are shaped like hands. The food consists chiefly of insects; but small reptiles, as well as birds and

their eggs, are attacked by the larger species. Some of them, like the species represented in the annexed figure (*Fig. 208*), have no pouch, and the young manage to keep their places upon the back of the mother, by very dexterously twisting their long tails round the tail of their parent.

Inferior to the Kangaroos and Opossums in some points of structure, but highly interesting in many respects, is the Ornithoryncus (*Fig. 209*). When the first specimens of this

creature arrived in Europe, and naturalists saw the body of a quadruped joined to the bill of a bird, they naturally suspected that the union was an artificial one. The real animal was in fact more wonderful than that which any dealer in "strange beasts" would have ventured to fabricate.



Fig. 209.—ORNITHORYNCUS.

The Ornithorynchus is about eighteen inches long, and is called by the natives of Australia the *water-mole*. It frequents tranquil waters, seeking its food among aquatic plants, and excavating its burrows in the steep and shaded banks. The motion of its mandibles, when procuring food, are similar to those of a duck under the same circumstances.

GNAWING ANIMALS.

RODENTIA.

THE preceding Order was composed exclusively of animals belonging to foreign countries. The present is well represented among our native quadrupeds, as the British species are illustrative of some of the most important families. The characteristics of the group are so well developed in the Rat and the Mouse, that the family to which they belong is regarded as the type or representative of the Order: and contains above 300 species.

The most striking characteristic of the gnawing animals is the structure of the teeth. The molar or grinding teeth,



Fig. 210.—MOLAR TEETH OF VOLE.



Fig. 211.—MOLAR TEETH OF BEAVER.



Fig. 212.—SKULL OF A GNAWING ANIMAL.

have ridges of enamel variously arranged (*Fig. 210, 211*), which keep up the inequality of surface, as they wear less rapidly than the other portions. The incisor or cutting teeth, with their chisel-shaped edges, are however more remarkable. These are the teeth which are so conspicuous in the front part of the mouth of the rat or the rabbit, and which are shown in the annexed figure (*Fig. 212*). They

continue growing during the entire life of the animal. New matter is ever added at the base, the enamel or hard coating of the teeth is deposited on the outer edge, the softer or inner portions of the teeth wear away, and thus the bevelled or sloping edge of these most efficient tools is invariably preserved.



Fig. 213.—HAMSTER.

Knowing these facts, we cannot examine the teeth of the Rabbit or the common Mouse, without being struck with the amount of design they exhibit, the care for the wants of the animal which they manifest, and the perfection in which the continual growth compensates for the constant wearing away.

We have in this Order several examples of animals which *hybernate*, or pass the winter in a greater or less complete state of torpidity. Thus, the Marmot of the Alps and Pyrenees dozes away the winter, until the



Fig. 214.—SQUIRREL.

sunshine and the showers of April rouse it from slumber. The Hamster of the North of Europe (*Fig. 213*) lays up in



Fig. 215.—JERBOA.

its winter quarters a plentiful store of grain, which it conveys from the fields in its capacious cheek pouches. The provident instincts of the Squirrel (*Fig. 214*) and the Dormouse need only be referred to. The Jerboa, or Jumping

Rat of Egypt (*Fig. 215*), although it does not hyber-nate, establishes stores of grain; and thus “pro-

videth her meat in the summer, and gathereth her food in the harvest.”

The Beaver (*Fig. 216*) is remarkable, as exhibiting one of the few examples known among quadrupeds, of an animal constructing its own habitation of materials selected for the purpose, brought from a distance, and cemented together into a regular structure. It is not surprising that a creature possessed of such powers, should have had them represented in exaggerated colours; that it should have been described as making use of its broad tail, both as a sledge and as a trowel; of being able to drive stakes, the thickness of a man's leg, three or four feet into the ground; and as enjoying the advantages of social policy and a settled system of government.

A better knowledge of the habits of the American Beaver has dissipated these idle tales, and shown that its intelligence is of a very limited description. Still the labours of the animal,



Fig. 216.—BEAVER.

apart from all exaggeration, cannot but excite our wonder; nor can we behold, without a lively interest, the scene presented by its populous villages. The flesh forms a delicious article of food, and the fur is so valuable that it constitutes an important branch of commerce. The Beaver was at one time a native of Britain, and is still found on the banks of the Rhone, the Danube, and other rivers of Europe.

TOOTHLESS ANIMALS.

EDENTATA.

IN the Ant-eater of South America, we have an example of a quadruped which has no teeth; its long tongue, covered with glutinous matter, being the means employed for entrapping its insect prey. Other animals belonging to the present group are not toothless; the true characteristic being the want of teeth in the front part of the jaw—that very part in which, in the preceding order, such careful provision seems to have been made for their continual growth.

The present Order is composed entirely of foreign species, and has been divided into three groups, one represented by the Ant-eater, a second by the Armadillo (*Fig. 217*), and the third by the Sloth (*Fig. 218*).

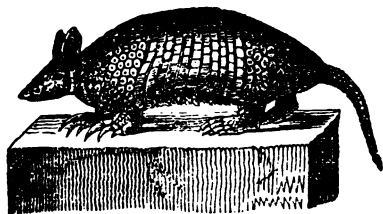


Fig. 217.—ARMADILLO.

The Armadillos are peculiar to the New World; no animals encased in a similar bony covering are found in any other part of the globe. They extend

from the banks of the Orinoco, through the whole of South America, and occupy the lower regions of the Andes to the same elevation as the Sloths, or about 3,000 feet. Their food is partly of animal and partly of vegetable substances and fruits.

The Sloths are found from the Southern limits of Mexico.

to Rio de Janiero. Their food consists exclusively of leaves and fruits. The Sloth has been spoken of by naturalists of high reputation as disproportioned in its parts, grotesque, imperfect, to whom existence must be a burthen. Such opinions have been exploded by a better knowledge of the habits of the animal. It is not destined to live upon the earth, but among the branches of trees, and not *on* them like the Squirrel, but *under* them. These things being known, each supposed defect of structure turns out to be in reality a new instance of the perfection and wisdom displayed in all the works of Nature.



Fig. 218.—UNAU, OR TWO-TOED SLOTH.

“The Sloth,” Mr. Waterton remarks, “is the only known quadruped that spends its whole life suspended by his feet from the branches of trees. The Monkey and the Squirrel seize a branch with their fore-feet, and pull themselves up, and rest or run upon it; but the Sloth, after seizing it, still remains suspended; and, suspended, moves along under the branch till he can lay hold of another.

RUMINATING ANIMALS.

RUMINANTIA.

“ Mightiest of all the beasts of chase,
 That roam in woody Caledon,
 Crashing the forest in his race,
 The mountain Bull comes thundering on.

“ Fierce on the hunter’s quiver’d band,
 He rolls his eyes of swarthy glow,
 Spurns with black hoof and horn, the sand,
 And tosses high his mane of snow.”

SCOTT’S “CADDOW CASTLE.”

THE ruminating animals are distinguished, as their very name imports, by their habit of *ruminating* or chewing the cud. They have four stomachs, live on vegetables, and are all possessed of the cloven hoof. Here only do we meet with species having the forehead armed with horns: every horned quadruped is, therefore, a ruminating animal.

They are widely spread over the earth, from the equator to the icy regions of the arctic circle; so that, wherever man is found, he is accompanied by those animals most necessary for the supply of his wants and comforts. From them he derives a considerable portion of his food and clothing, whether in a savage or civilized state of society. ~~That~~

milk, their flesh, their wool, hides, horns, and hoofs, are all converted to his uses ; whilst from many of them he derives the most valuable assistance in the labours of the field, and in the transport of commodities. Thus, the Reindeer (*Fig. 219*) is to the Laplander his chief source of comfort and



Fig. 219.—REINDEER.

principal means of subsistence. It furnishes him both with food and raiment; and in a country where neither the horse nor the cow could live through the winter, it supplies the place of both.

The ruminating animals are divided, by Mr. Waterhouse, into nine groups.

I. The Camels: the Arabian Camel, from the earliest ages to the present day, has formed the chief means of communication between the different countries of the East, and has been, in the sultry regions where it is found, scarcely less important to man, than is the Reindeer amid the snowy wastes of Lapland.

II. The Llamas have been justly termed the "Camels of the New World," and differ from them in being of smaller size, and in the absence of the hump. They belong exclusively to South America; and, unlike their Old World relatives, who inhabit "Araby the blest," and other sunny regions, they are found amid the bleak and rocky precipices bordering on the limit of perpetual snow.

III. The Musk Deer, from which the substance called "musk" is procured. These are natives of Asia, and are entirely without horns.



Fig. 220.—THE STAG.

IV. The Deer.—These animals combine, in the highest degree, the characteristics of elegance of form, grace, and fleetness (*Fig. 220*) The

Elk or Moose Deer of America, exceeds in size any species now living. It was, however, much surpassed by that extinct

species known as the "Irish Elk," and especially as regards the size of the antlers, which weighed from 60 to 70 lbs. In the Moose, the span of the antlers between the extreme tips is four feet; in the extinct Irish species, it is eight feet.

The three species of Deer now living in these countries are the Fallow Deer, the Red Deer, and the Roebuck. The horns are thrown every year, as they were in the extinct species, and their place supplied by a new growth. The horns are solid, and in their structure resemble bone.—Those of the Ox or the Goat, on the contrary, are hollow, covering the bony portion as a sheath would do, and are formed of that elastic substance to which we give the name of horn. From the difference in the structure of their horns, therefore, animals of the present order may be grouped as *solid* or as *hollow-horned* Ruminants.



Fig. 221.—GIRAFFE.

V. The Giraffe or Camelopard (*Fig. 221*) is confined to the continent of Africa. It browses upon the foliage and

tender shoots of trees, and has a tongue so constituted as to serve, like the proboscis of the Elephant, as an instrument for pulling them down.



Fig. 222.—GAZELLE.

VI. ANTELOPES.—The traveller among the Alps or the Pyrenees, describes one species of this group, the Chamois, and the poets of eastern tale have celebrated the praises of another—the Gazelle (*Fig. 222*).

“Her eye’s dark charm ’twere vain to tell,
But gaze on that of the Gazelle,
It will assist thy fancy well;
As large, as languishingly dark.”—BYRON.

The beautiful species represented in the annexed figure (*Fig. 222*), is common in the North of India. By means of their extreme velocity, and the great length of their bounds, they can distance the fleetest dogs. They are, however, sometimes surprised by the Chetahs, or Hunting Leopards, trained for the purpose, and are also occasionally flown at by hawks, which keep them occupied until the dogs have time to come up with them and seize them.

Moore has noticed, in one harmonious stanza, the graceful movement of the Antelope, and the nature of the localities in which it is found:—

“Our hills are bare, but down their slope
The silv’ry-footed Antelope,
As gracefully and gaily springs
As in the marble court of kings.”

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al
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VII. The Goats constitute the next family; they also are inhabitants of Alpine regions.



Fig. 223.—INDIAN ANTELOPE.

VIII. The eighth family consists of the different species of Sheep, which may be traced originally to Western Asia. In a wild state they herd on mountainous districts.

IX. The remaining group may be represented by our

domestic Oxen, which have ever been associated with the field labours and the domestic comforts of man. Perhaps no species has been more celebrated than the Bisons (Fig. 224), which roam in numerous herds over the trackless prairies of



Fig. 224.—Bison.

America. Lewis and Clarke, who witnessed more than once the grand spectacle presented by an assembly of Bisons, say, on one occasion—"If it be not impossible to calculate the moving multitude which darkened the whole plains, we are convinced that 20,000 would be no exaggerated number."

THICK-SKINNED ANIMALS.

PACHYDERMATA.

“Beside him stalks to battle,
 The huge earth-shaking beast—
 The beast on whom the castle
 With all its guards doth stand;
 The beast who hath between his eyes
 The serpent for a hand.”

MACAULAY’S “LAYS OF ANCIENT ROME.”

THE animals of the present Order are, in their general habits, herbivorous. One of their most obvious characteristics is the toughness and great thickness of the skin; from this peculiarity the scientific name for the order has been derived. Most of the species belong to the torrid zone; but none are found in Australia.

The Elephant, both of India and of Africa—for there are two species—has been celebrated for his strength, docility, inoffensive habits, and usefulness to man; and the term “half-reasoning Elephant,” which has been applied to him by the poet, indicates that remarkable sagacity of which so many well-authenticated anecdotes are told.

The food of the Elephant, when in a state of nature, consists not merely of leaves, but of the twigs and branches of

trees. It is needful, therefore, that he should have teeth fitted to grind down the woody fibre, and with some power of renewal which would make up for the continual wearing away. The teeth are, therefore, composed of three sub-

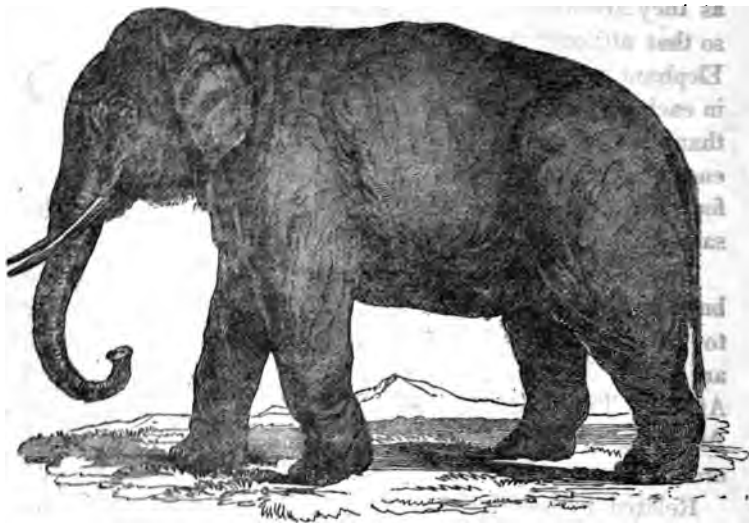


Fig. 225.—INDIAN ELEPHANT.

stances of different degrees of hardness; this causes the surface to wear away in an unequal manner, and hence the property which makes a millstone most valuable is secured. The arrangement to make good what a mechanic would call "the wear and tear" of the apparatus is not less effectual. The teeth are ever growing, not as in the gnawing animals.

(page 217), by the deposit of fresh matter at the base, but by the development of new teeth. These appear in succession as they are wanted; so that although an Elephant may have in each jaw not less than six of these enormous molar teeth in the course of its life, or twenty-four in all, never more than two are seen in each jaw at the same time.

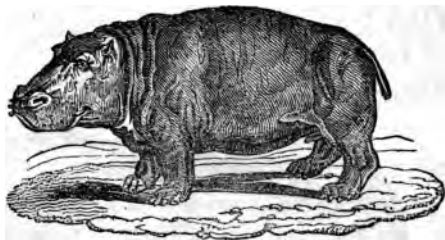


Fig. 226.—HIPPOPOTAMUS.

The Hippopotamus or “River-horse” (*Fig. 226*), whose bulk is scarcely inferior to that of the elephant, is peculiar to Africa; but the Rhinoceros (*Fig. 206*), of which there are seven species, is distributed through both Asia and Africa. The wild Boar of Europe, and the Peccaries of America, are examples of families belonging to the present order.

Related by peculiarities of structure to the Elephant, the Rhinoceros, and the Hog, is the Tapir. The species represented in the annexed figure (*Fig. 227*) is a native of America, and is about the size of a calf of six months old. Its most remarkable feature consists in the prolongation of the nose into a moveable proboscis, which extends several inches beyond the mouth, and is capable of being moved at will in various directions. The Tapir is found in every part

of South America, from the straits of Magellan to the Isthmus of Darien; it is extremely inoffensive, and never attacks either man or beast, except in self-defence, or under circumstances of great provocation.

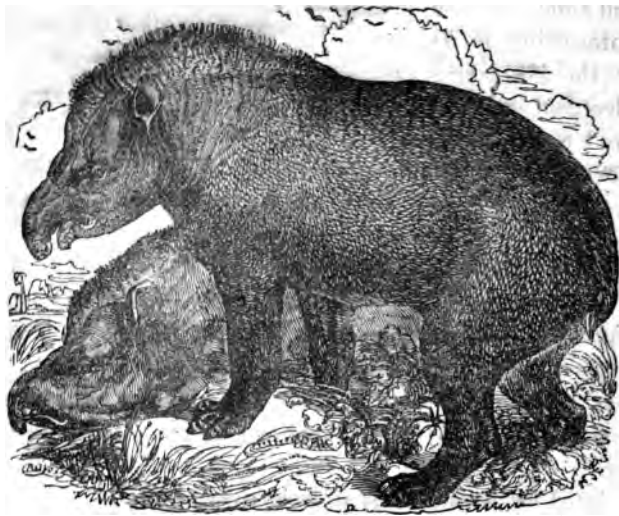


Fig. 227—TAPIR.

The family to which the Horse belongs is universally distributed, either in a wild or a domesticated state. The wild Asses extend from Siberia to Egypt; and the different species of Zebra (*Fig. 228*) throughout central and southern Africa, some inhabiting the plains, others selecting the mountains.

The species of the present order which are most remarkable for size are, as has been already mentioned, natives of the torrid zone. It is highly interesting to know that the researches of modern naturalists have proved their existence, in former ages, in our own temperate clime.



WHALES, DOLPHINS, PORPOISES.

CETACEA.

“Leviathan,
Hugest of living creatures, on the deep
Stretch'd like a promontory, sleeps or swims,
And seems a moving land.”—MILTON.

THESE animals are distinguished by their fish-like form, their flat horizontal tail, and by the anterior extremities being in the form of fins. They were divided by Cuvier into two families—those that live on vegetable, and those that live on animal food. The latter group is divided into

three families, which may be represented by the Dolphin, the Spermaceti Whale, and the Baleen Whale, in all of which the nostrils are situated on the crown of the head, and act as blow-holes.

The common Dolphin is occasionally met with on the British shores, and is remarkable for the activity and playfulness of its gambols, and its evident delight in companionship. In these respects it resembles the common Porpoise



Fig. 229.—PORPOISE.

(*Fig. 229*), which, of all the Cetacea, is the species most usually seen around our coasts, entering our bays in pursuit of shoals of Herrings, and other fish, and attracting attention by the manner in which it rolls over, as it comes to the surface to breathe. The length of the body is from four to six feet.

The Cachalot or Spermaceti Whale, derives its common name from the peculiar and useful substance which it affords. The head is of enormous bulk, its length being nearly equal to half the entire length of the animal. The spermaceti, in a fluid state, is contained in compartments in the front part of the head. The creature reaches the length

seventy feet; and its strength is so enormous, that a ship of large size has been stove in and foundered, by a blow inflicted by the head of an infuriated male cachalot of large size.

The Common or Baleen Whale (*Fig. 230*) feeds upon small crustacea, mollusca, and medusæ. This it is enabled to do by a beautiful apparatus, which, acting as a sieve, allows the water to escape, while the minute ani-

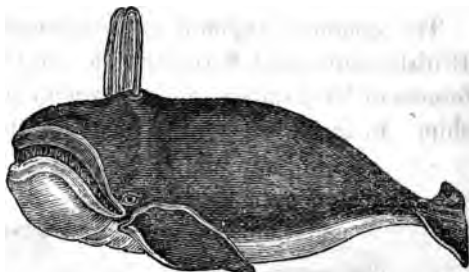


Fig. 230.—BALEEN WHALE.

mals diffused through it are retained. This sieve consists of a series of horny plates (*Fig. 231*) which hang like a fringe from the upper jaw, and are well known by the common, though not very correct appellation, of "whale-bone."

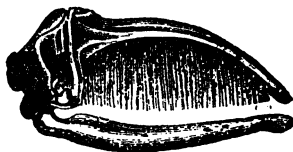


Fig. 231.—SKULL OF WHALE.

Other arrangements, no less perfect, are observable in the Whale, and adapt it for being the inhabitant of the arctic seas. The tail (*Fig. 230*), as has been already mentioned, is horizontal, while in fishes it is vertical. By fishes it is used as an instrument for progression in the water, and they may speed onwards in their course at nearly the same

uniform depth. But from the very nature of their organization, Whales are compelled to rise to the surface for each respiration; and as the tail is horizontal, it acts as an oar of inconceivable power; its superficial measurement in the larger species being not less than one hundred feet.

The substance to which we give the name of "blubber," is arranged in such a way as to protect the animal from the pressure of the water, which must be enormous at the vast depths to which it descends; while, at the same time, it acts as a blanket in maintaining the heat of the body. Nor does its utility stop even here; it is specifically lighter than the sea-water, and though its weight sometimes exceeds thirty tons, it does not act as an incumbrance, but in reality renders the animal more buoyant.

Thus provided, the Rorqual, of ninety or a hundred feet in length, the largest of all Whales, and, consequently, of all existing animals, can propel its enormous bulk through the water, or float at ease upon the surface. Respecting such a creature, Milton, in the following beautiful lines, has recorded a tradition at one time current:—

"Him, haply slumbering on the Norway foam,
The pilot of some small night-founder'd skiff
Deeming some island, oft, as seamen tell,
With fixed anchor in his scaly rind,
Moors by his side under the lee, while night
Invests the sea, and wished morn delays."

FLESH-EATING ANIMALS.

CARNIVORA.

—————"The Tiger darting fierce
 Impetuous on the prey his glance has doom'd;
 The lively, shining Leopard, sparkled o'er
 With many a spot, the beauty of the waste;
 And scorning all the taming arts of man."—THOMSON.

THE animals belonging to the present Order are those which live principally upon the flesh of other vertebrate animals, and in popular language are termed beasts of prey. They have been arranged in five families.



Fig. 232.—SEAL.

I. The first is that of the Seals (*Fig. 232*). Like the Whales, they are warm-blooded mammalia, living in the sea; but they are at once distinguished from them by the absence of the broad, flat, horizontal tail, the presence of four feet, shaped like fins, and other peculiarities. Their great haunt is the sea of the arctic regions, and the *fishery*, for so it is termed, is one of great value, both for the oil and the skins.

II. The Bears are remarkable for their great strength, their ponderous body, and their peculiar gait. The food of the

American Black Bear is principally vegetable; that of the Polar Bear is flesh, mostly that of the Seals. The Brown Bear (*Fig. 233*) is found in the mountainous parts of the Continent of Europe, and was formerly a native of Britain.



Fig. 233.—BROWN BEAR.

III. The family of the Weasels includes some well-known species: one of these is the Otter, which lives principally upon fish, and has occasionally been taught to aid the fisherman in his labours. All these animals are remarkable for the slenderness and flexibility of their bodies. The annexed figure of the Marten (*Fig. 234*) represents a species which

takes up its abode in the hollow trunks of trees, and lives upon small birds, which it captures by the great activity of its movements. The Ermine Weasel or Stoat, like the Alpine



Fig. 234.—PINE MARTEN.

Hare or the Ptarmigan, changes the colour of its covering in winter to a snowy white. The fur is then in that condition in which it is most valuable, the pure white of the skin contrasting with the deep black colour of the tail.

IV. The various races of the Dog belong to this family; and although they differ so much from each other, the opinion prevails that they have all had a common origin. The Fox and the Wolf are members of this group; and the Wolf (*Fig. 235*), in the opinion of Professor Bell, is the source whence all our domestic dogs have sprung.

The noble animals represented in *Fig. 236*, are the Thibet dogs. They are of gigantic size, and are the watch-dogs of the table-land of the Himalaya mountains. They are said to have a great aversion to strangers,



Fig. 235.—WOLF.



Fig. 236.—THIBET DOG.

and in general fly ferociously at the white face of a European.

V. The Cat tribe—this includes the Lion, the Tiger, the Panther, the Leopard, the Puma, and other quadrupeds remarkable for their destructive powers. They serve to keep within bounds the excessive multiplication of the smaller mammalia, and are widely distributed. The Wild Cat is now the only representative of the group in these countries.

The Leopard (*Fig. 237*) is a native of Southern Asia, and

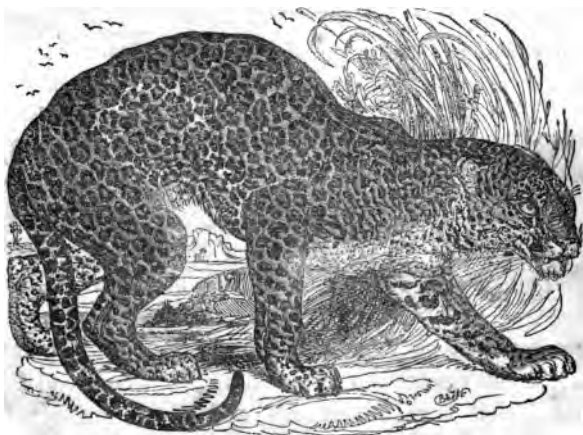


Fig. 237.—LEOPARD.

of nearly the whole of Africa, inhabiting the woods, and preying chiefly on Antelopes, Monkeys, and the smaller quadrupeds. It climbs with great facility. The individual represented in the annexed figure was at one time living in the menagerie of the Zoological Society of London.

INSECT-EATING ANIMALS.

INSECTIVORA.

"Pray you tread softly, that the blind Mole may not
Hear a foot fall."—SHAKESPEARE.

THE animals belonging to the present Order have teeth which are raised into pointed and conical summits. The



Fig. 238.—SHREW.

Shrew, or as it is popularly called the "Shrew Mouse" (*Fig. 238*), the Hedgehog, and the Mole, are examples of British species of this Order, representing different families.

The Mole is not found in any part of Ireland. It has no external ears, and the eyes are so extremely minute, that in popular language it is always spoken of as "blind." The broad forefeet with the palms turned outwards, and so admirably adapted for digging, are the most striking characteristic. The food consists of insects and worms; and as the animal does not become dormant during the winter, the necessity of exertion to obtain the needful supply of food is continual.

The figure is copied from Professor Bell's "British Quadrupeds," by the kind permission of the learned author. I will

that the brief extracts here given from that work, could induce such of my readers as have the opportunity, to refer to it for fuller information. The Mole, "blind, awkward, and shapeless," condemned to a life of toil in subterranean darkness, seems to the superficial observer an object of pity. To

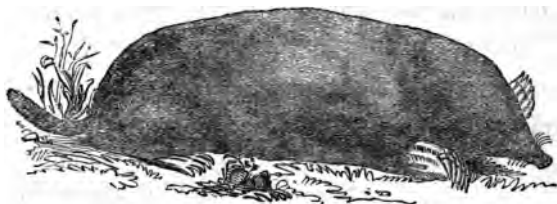


Fig. 239.—MOLE.

the naturalist it affords another proof "of the wisdom and beneficence of the Creator, which can render a life so apparently incompatible with comfort, in reality one of almost incessant enjoyment."

"Its feeding and its habitation, its wanderings, and its repose, its winter retreat, and the nest in which its young are brought forth and nourished, are all so many calls for the most laborious and enduring toil; but on the other hand, that toil is so amply provided for in the whole structure of the animal, so exactly balanced by the strength and conformation of its limbs, that it cannot be considered as exceeding the healthful, and even pleasurable exercise of its natural powers."

B A T S.

C H E I R O P T E R A.

"The Bat, that with hook'd and leathery wings
Clung to the cave-roof."—SOUTHEY.

WHEN we see the Bat flitting about after its insect prey in the dusk of the summer evening, we at once recognise it as an insectivorous animal, adapted for capturing its food in the air instead of on the earth. We then are naturally led to



Fig. 240.—BAT.

inquire by what means is this effected? what is the mechanism by which the power of flight is given to the Bat? It is furnished with wings. Do they resemble those of the bird?

They are altogether unlike, differing not only in the absence of feathers, but in their entire structure. In birds the feathers are principally attached to bones which correspond with those of our arm. But to compare the bones of the Bat's wing with those of the human frame, let us suppose the skeleton of a man with the fore-arm greatly prolonged, and the fingers about a yard and a-half in length. The bones would then form a framework somewhat similar to that of an umbrella, and capable like it of being shut or opened.



Fig. 241.—BAT WALKING

Let us suppose this bony framework covered with some light and pliant material, which is continued between the legs and down to the ancles, and we would then have a figure resembling in the organs of flight, that which is in reality possessed by the Bat (*Fig. 240*). The elongated bones of the fingers form the framework of the wing; and hence the order is designated by a scientific term, which literally means "hand-winged."

If a Bat be placed on the smooth surface of a table, its awkward attempts at walking (*Fig. 241*) give an idea of helplessness akin to that which was suggested to naturalists when the Sloth was seen upon the ground. Yet compassion in both cases would be alike misplaced. Each animal is gifted with powers of locomotion adapted to its wants. The

Bat can climb with ease the rugged and perpendicular surface of a tree, or can wheel its flight in the air, though burthened with one or two young adhering to its teats.



Fig. 242. —HEAD OF VAMPIRE.

The use of the wings does not seem to be limited to that of flight. They appear to be endowed with a most delicate sense of touch, a sense so exquisitely fine as to be affected by the slightest difference in the vibrations of the air. By the cruel experiments of Spallanzani, it was proved that Bats deprived of sight could fly without striking against walls or other objects, and were even able to avoid coming into contact with threads placed across the apartments in various directions.

Many tribes of Bats, which are natives of foreign countries, have curious leaf-like appendages upon the nose; and these are believed to be organs of smell. The size of some Bats appears very considerable, when contrasted with that of our most common native species. There is one in the island of Java, the expanse of whose wings is so much as five feet.

M O N K E Y S .

QUADRUNANA.

“Meddling Monkey—busy Ape.”—SHAKSPEARE.

THOSE who have visited a zoological garden, or a well-stocked menagerie, cannot fail to have been amused at the freaks and gambols of the monkeys; and after watching for a time their agile movements and grotesque attitudes, must have been struck with the peculiar formation of the extremities, both of the feet and of the paws. The feet are not shaped like ours, but resemble hands, being furnished with fingers and with thumbs. In fact they do not perform the functions of feet only, but of hands also. Hence that order to which the Monkeys belong bears a scientific name, signifying “four-handed.” It may be divided into three groups—the Lemurs, the Monkeys of America, and those of the Old World.

“The Lemurs,” says Mr. Bennet, “are all natives of Madagascar, and one or two smaller islands in its neighbourhood. We know but little of their habits in a state of nature; but they are said to live in large bands upon the trees, feeding principally upon fruits; and their conformation renders this account extremely probable. They are almost equally agile with the Monkeys, but are much more gentle

and peaceable in their dispositions." It will be seen, from the accompanying figure (*Fig. 243*), that both extremities are

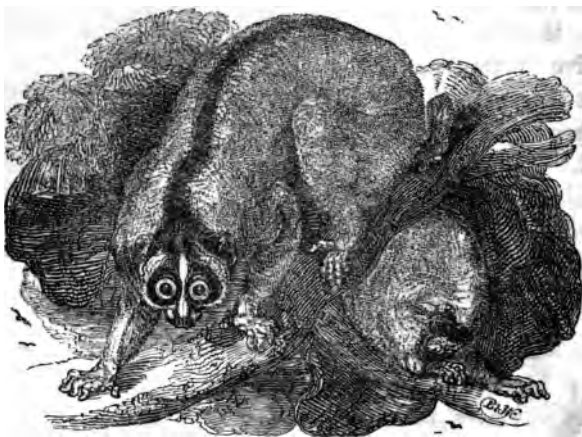


Fig. 243. — SLOW-PACED LEMUR.

furnished with a thumb, which acts in a direction opposite to that of the fingers.

In this respect the Lemurs form a contrast to the American Monkeys, which can only use the thumb belonging to the fore paws in a line with the other fingers, as represented in the annexed figure of the Marmozet or Oustiti of Brazil (*Fig. 244*). The thumb on the feet can, however, be employed with the same ease and freedom as in any of the other tribes. This single circumstance distinguishes the American Monkeys from all others. For those animals which, like the

Opossums and American Monkeys, have opposable thumbs on the feet, but not on the fore paws, the expressive term "foot-handed" has been proposed.

The warmer portions of the American continent are the parts in which Monkeys particu-



Fig. 244.—OUSTITI.

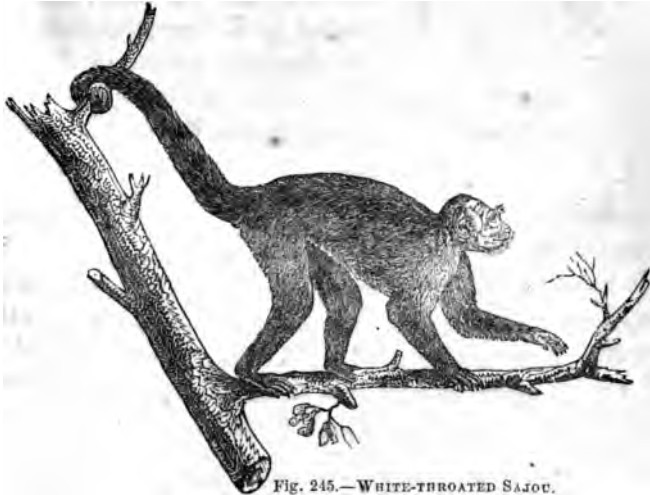


Fig. 245.—WHITE-THROATED SAJOU.

larly abound. They dwell amid the branches of trees, living

on fruits and vegetables, with the addition of insects, lizards, and the eggs and young of birds. Many of them use the tail as an instrument for laying hold of the branches (*Fig. 245*), and thus passing with ease from tree to tree, or swinging in full activity suspended from the boughs.



Fig. 246.—CHIMPANZEE.

The Monkeys of the Old World are distinguished in common phraseology by the names of Apes, Monkeys, and Baboons. Like those of the American continent, they are limited to the torrid regions, and are, therefore, natives of Asia and Africa. To this there is only one exception, the Barbary Baboon, a native of Northern Africa, which has established a colony on the Rock of Gibraltar.

Among the Apes we find the Orang Outan and the Chimpanzee (*Fig. 246*). The number of anecdotes recorded of them, establish their intelligence and docility. Here we find the nearest approach to man that is permitted to the inferior animals; but vast and impassable is the barrier of separation.

MAN.

B I M A N A .

“Two of far nobler shape, erect and tall,
 Godlike erect, with native honour clad,
 In naked majesty seem'd lords of all;
 And worthy seem'd; for in their looks divine
 The image of their glorious Maker shone.”

PARADISE LOST.

MILTON, in these lines, has described one of the most striking external characteristics of Man, his erect gait. The zoologist points to the human hand as presenting another mark of distinction. In man only can the thumb be applied with such precision and power, to each of the fingers, as to seize the most minute objects. So much superior is it to the anterior extremity in Monkeys, that Sir Charles Bell remarks:—“We ought to define the hand as belonging exclusively to Man.” Of all animals, the term *Bimana*, or two-handed, is applicable to Man alone. He stands in the scale of the animal creation apart and unapproachable, gifted with dominion over “the beasts of the field, the fowl of the air, and the fish of the sea, and whatsoever passeth through the paths of the sea.”

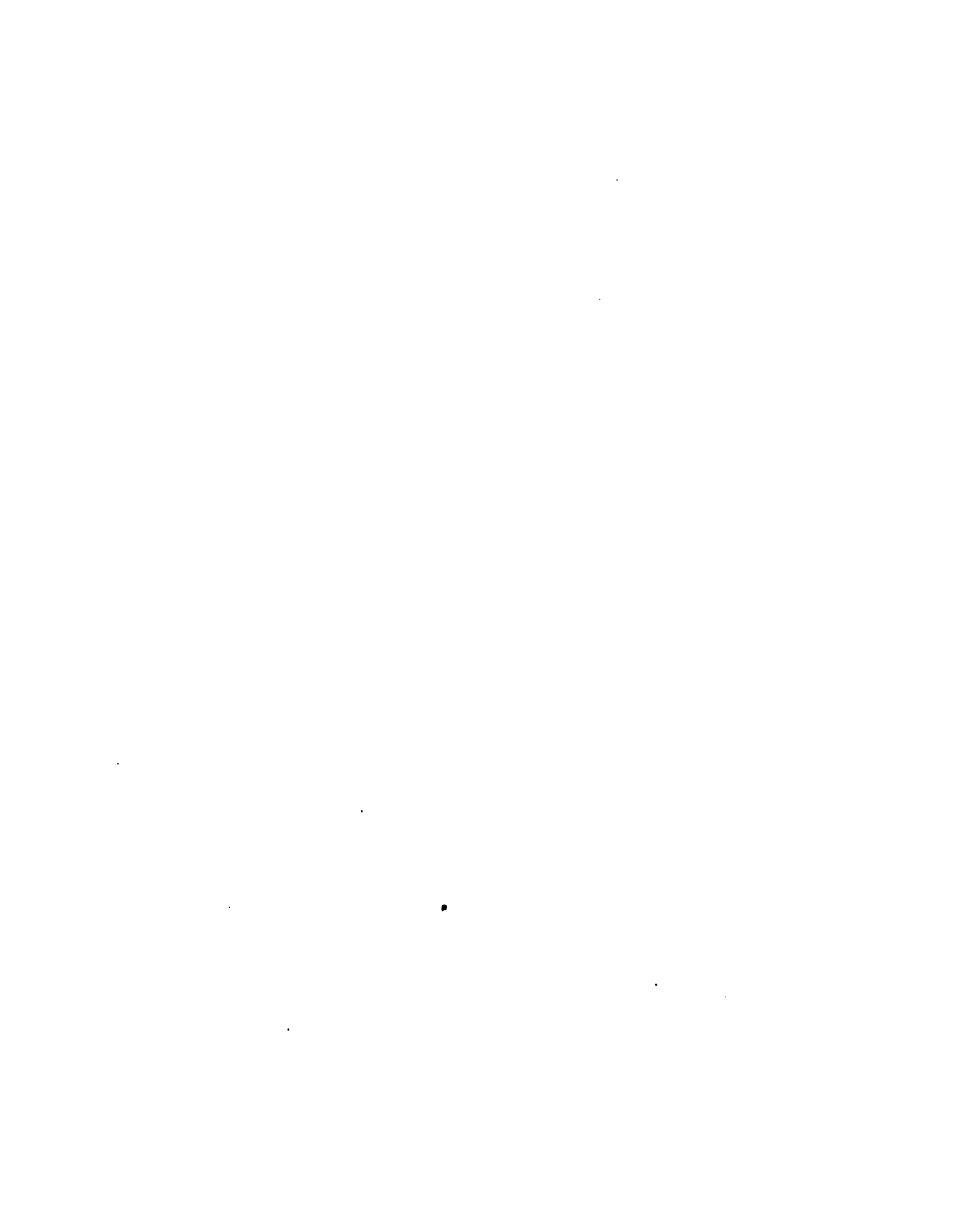
It is not intended in this little book to enter into the Natural History of Man; but only to show the place he occupies in the classification of the animal kingdom, and the external peculiarities by which he is distinguished.

Reference to his intellectual and moral faculties would here be out of place.

But ere I part with the youthful readers for whom this volume is intended, I would say to them, that, if they have found it at times dull and unattractive, let them blame the author, and not the subject, and go forth and examine for themselves the happy tribes of the air, the earth, and the waters. Should they do so, they will never find a "whole holiday" tedious, nor have cause to say that they feel dull or languid for want of something to do. The pursuits to which I would direct them give enjoyment to youth, relaxation to manhood, and occupation to age. They furnish pleasant thoughts and healthful exercise; and they teach us to read the volume of Nature with a constant reference to its great and beneficent AUTHOR.

"To us invisible, or dimly seen
In these his lowest works."

THE END.



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